National Marine Fisheries Service
Endangered Species Act Section 7 Consultation
Biological Opinion and Magnuson–Stevens Act
Essential Fish Habitat Consultation

Action Agencies:

National Marine Fisheries Service (NMFS), (Lead Agency)
The Bonneville Power Administration (BPA)
The U.S. Fish and Wildlife Service (USFWS)
The U.S. Geological Survey (USGS)
The U.S. Forest Service (USFS)
The U.S. Environmental Protection Agency (USEPA)
The U.S. Bureau of Land Management (BLM)
The U.S. Army Corps of Engineers (USACE)

Species/ESUs Affected:

Threatened Upper Willamette River (UWR) chinook salmon (*Oncorhynchus tshawytscha*)
Threatened Lower Columbia River (LCR) chinook salmon *(O. tshawytscha*)
Threatened UWR steelhead (*O. mykiss)*
Threatened LCR steelhead (*O. mykiss)*
Threatened Columbia River (CR) chum salmon (*O. keta)*

Activities Considered:

1. Issuance of Permit No. 1102 to the Washington Department of Fish and Wildlife (WDFW)/Oregon Department of Fish and Wildlife (ODFW)
2. Issuance of Permit No. 1134 to the Columbia River Intertribal Fish Commission (CRITFC)
3. Issuance of Permit No. 1156 to the Dynamac Corp/USEPA
4. Issuance of Permit No. 1140 to the NMFS Northwest Fisheries Science Center (NWFSC)
5. Issuance of Permit No. 1135 to the USGS
6. Issuance of Permit No. 1175 to the Gifford Pinchot National Forest (GPNF)
7. Issuance of Permit No. 1252 to the Washington Department of Transportation (WDOT)
8. Issuance of Permit No. 1256 to the BLM
9. Issuance of Permit No. 1290 to the NWFSC
10. Issuance of Permit No. 1291 to the USGS
11. Issuance of Permit No. 1293 to the Northern Resource Consultants (NRC)
12. Issuance of Permit No. 1312 to the Olympic Resource Management (ORM)
13. Issuance of Permit No. 1318 to the ODFW
14. Issuance of Permit No. 1326 to the Cascade General, Inc. (CGI)
15. Issuance of Permit No. 1327 to the Western Washington University (WWU)
16. Issuance of Permit No. 1328 to the Lower Willamette Group (LWG)
17. Issuance of Permit No. 1329 to the NWFSC
18. Issuance of Permit No. 1330 to Weyerhaeuser Company (WeyCo)

19. Issuance of Permit No. 1333 to the Oregon State University (OSU)
20. Issuance of Permit No. 1334 to the Oregon Metallurgical Corporation (OREMET)
21. Issuance of Permit No. 1335 to the USFS
22. Issuance of Permit No. 1336 to the Port Blakely Farms (PBF)
23. Issuance of Permit No. 1337 to the OSU
24. Issuance of Permit No. 1338 to the USFWS

Consultation Conducted by: The Protected Resources Division (PRD), Northwest Region, NMFS
Consultation Number F/NWR/1998/01377

Approved by: D. Robert Lohn

Date: February 20, 2002 (**Expires on:** December 31, 2006)

This Biological Opinion (Opinion) constitutes NMFS' review of 24 Endangered Species Act (ESA) section 10(a)(1)(A) permit applications affecting UWR chinook salmon, LCR chinook salmon, UWR steelhead, LCR steelhead, and CR chum salmon. It has been prepared in accordance with section 7 of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). This Opinion is based on information provided in the applications for proposed permits, comments from reviewers, published and unpublished scientific information on the biology and ecology of threatened salmonids in the action area, and other sources of information. A complete administrative record of this consultation is on file with the PRD in Portland, Oregon.

CONSULTATION HISTORY

NMFS proposes to issue two permit modifications, two amendments to existing permit modifications, and 20 new permits authorizing scientific research studies of threatened UWR chinook salmon, threatened LCR chinook salmon, threatened UWR steelhead, threatened LCR steelhead, and threatened CR chum salmon. The Northwest Region's PRD decided to group these actions into a single consultation pursuant to 50 CFR 402.14(c) because they are similar in nature, occur in similar locations, and will affect the same threatened species. This Opinion constitutes formal consultation and an analysis of effects solely for the five threatened species listed above. Some of the proposed research activities may affect ESA-listed species under the jurisdiction of the USFWS (e.g., threatened bull trout (*Salvelinus confluentus*)). Permit applicants are required to obtain a take authorization from the USFWS if ESA-listed species under its jurisdiction are expected to be encountered. The consultation histories for each of the permits are summarized below.

Permit No. 1102—for the WDFW/ODFW.
On January 15, 1998, the PRD received an amended permit application from the WDFW and the ODFW, in Olympia, Washington and Portland, Oregon respectively, requesting take of adult LCR steelhead and LCR chinook salmon carcasses as part of a second study. The PRD subsequently asked for additional numbers and types of fish to be taken, which were received February 13, 1998 and March 2, 1998. Modification 1 to Permit 1102 was issued on March 13, 2000, without authorizing take of this listed species since protective regulations under section 4(d) of the ESA had not yet been promulgated by NMFS. Take of adult LCR chinook salmon was also requested but subsequently assigned to the CRITFC in Permit 1134.

Permit No. 1134—for the CRITFC.
On February 9, 1999, the PRD received a request from the CRITFC in Portland, Oregon to modify Permit 1134 to include take of adult LCR chinook salmon. The PRD subsequently asked for additional information on the numbers and types of fish to be taken and received revised take numbers in July, November, and December 1999. Modification 1 to Permit 1134 was issued on July 10, 2000, without authorizing take of this listed species because protective regulations under section 4(d) of the ESA had not yet been promulgated by NMFS. Take of LCR steelhead was also requested but subsequently assigned to the WDFW/ODFW in Permit 1102.

Permit No. 1156—for the EPA.
On April 7, 2000, the PRD received a request to modify Permit 1156 from the EPA/Dynamac in Corvallis, Oregon. Dynamac Corporation is a cooperator with the scientific research and its biologists are authorized to act as agents of the EPA in conducting the research. The modification would allow the EPA/Dynamac to expand the scope of the project.

Permit No. 1140—for the NWFSC.
On December 22, 1999, the PRD received a request to modify Permit 1140 from the NWFSC in Seattle, Washington. The PRD subsequently received three more modification requests on January 31, 2000 to incorporate newly listed species, April 4, 2000 to recalculate take based on revised abundance estimates, and April 16, 2000 to incorporate new personnel and research activities.

Permit No. 1135—for the USGS.
On February 9, 1998, the PRD received a permit application from the USGS in Cook, Washington. The PRD subsequently received on March 17, 1998, and December 18, 1998, a recalculated steelhead take estimate and a request for an increased take. Permit 1135 was issued to the USGS on June 18, 2001.

Permit No. 1175—for the GPNF.
On July 21, 1998, the PRD received a permit application from the GPNF in Vancouver, Washington. The applicant sent a revised application on October 5, 2000 to address take of additional species and to update estimates of take. On July 11, 2001, the GPNF sent a list of rivers to be sampled and species that may be taken during the scientific research.

Permit No. 1252—for the WDOT.
On April 14, 2000, the PRD received a permit application from the WDOT in Olympia, Washington. The PRD received a revised take estimate on May 22, 2000, and an amended list of field personnel on February 26, 2001.

Permit No. 1256—for the BLM.
On March 13, 2000, the PRD received a permit application from the BLM in Eugene, Oregon. The PRD subsequently asked for, and received on June 29, 2001, additional information on specific locations where the activities are proposed to be conducted.

Permit No. 1290—for the NWFSC.
On December 14, 2000, the PRD received a permit application from the NWFSC in Seattle, Washington. The PRD subsequently received revised take tables on February 21, 2001, and an application for an additional study on March 1, 2001.

Permit No. 1291—for the USGS
On January 23, 2001, the PRD received a permit application from the USGS in Cook, Washington.

Permit No. 1293—for the NRC.
On January 19, 2001, the PRD received a permit application from the NRC in Longview, Washington.

Permit No. 1312—for the ORM.
On January 29, 2001, the PRD received a permit application from the ORM in Aberdeen, Washington.

Permit No. 1318—for the ODFW.
On February 8, 2001, the PRD received a permit application from the ODFW in Portland, Oregon. Additional information was received on February 6, 2002.

Permit No. 1322—for the NWFSC.
On May 17, 2001, the PRD received a research permit application from the NWFSC. The PRD subsequently asked for, and received on June 8, 2001, a revised application containing a number of clarifications regarding the original application.

Permit No. 1326—for CGI.
On December 18, 2000, the PRD received a permit application from Robert Ellis—a research contractor to CGI in Portland, Oregon. The PRD subsequently asked for additional information on the numbers and types of fish to be taken and received this information on January 24, 2001.

Permit No. 1327—for WWU.
On March 30, 2001, PRD received a permit application from WWU in Bellingham, Washington. The PRD contacted the applicant several times in April and May 2001 to obtain more detailed information on the proposed activities. An updated application was faxed to PRD on May 14, 2001.

Permit No. 1328—for LWG.
On May 14, 2001, the PRD received a permit application from Robert Ellis—a research contractor to the LWG in Portland, Oregon.

Permit No. 1330—for Weyerhaeuser Company.
On January 8, 2001, the PRD received a permit application from the WeyCo in Federal Way, Washington. The PRD contacted the applicant several times in April and May 2001 to obtain more detailed information on the proposed activities.

Permit No. 1333—for OSU.
On June 19, 2001, the PRD received a permit application from OSU in Corvallis, Oregon.

Permit No. 1334—for the OREMET.
On February 26, 2001, the PRD received a permit application from CH2M Hill—a research contractor to OREMET in Portland, Oregon. The PRD contacted the applicant on May 9, 2001, to obtain more detailed information on the proposed activities. Additional information and revised tables were faxed to PRD on May 10, 2001.

Permit No. 1335—for the USFS.
On May 10, 2001, the PRD received a permit application from the USFS in Corvallis, Oregon. The PRD contacted the applicant on several occasions in June, to obtain more detailed information on the proposed activities. Additional information and revised tables were provided to the PRD.

Permit No. 1336—for the PBF.
On December 14, 2000, the PRD received an application for a permit from the PBF in Tumwater, Washington.

Permit No. 1337—for OSU.
On March 8, 2001, the PRD received a permit application from OSU in Corvallis, Oregon.

Permit No. 1338—for the USFWS.
On June 21, 2001, the PRD received a permit application from the USFWS in Vancouver, Washington, for ongoing studies on chum salmon in the Columbia River Basin. The PRD contacted the applicant on several occasions in June and July 2001, to obtain more detailed information on the proposed activities. Additional information and revised tables were provided to the PRD on June 29, 2001.

On November 16, 1999, NMFS completed a formal consultation [F/NWR/2000/00680] on these studies before take prohibitions were placed on CR chum salmon. The USFWS requested a reinitiation of the consultation on August, 18, 2000. The reinitiated consultation was signed on November 30, 2000.

DESCRIPTION OF THE PROPOSED ACTIONS

Common Elements among the Proposed Actions

NMFS proposes that all 24 of the permit actions considered in this Opinion should be in effect for five years; that is they would expire on December 31, 2006. Some of the activities identified in the proposed permit actions will be funded by several Federal agencies including NMFS, the BPA, the USACE, the USGS, the USFWS, the USFS, and USEPA. Although these agencies are also responsible for complying with section 7 of the ESA because they are funding activities that may affect ESA-listed species or their designated critical habitats, this consultation considers the activities they propose to fund and will fulfill their section 7 consultation requirement.

Also, in all instances where a permit holder does not expect to indirectly kill any listed fish during the course of his or her work, the indirect lethal take figure has been set to 0.2% of the requested take. The reason is that, on occasion, unforseen circumstances can arise and NMFS has determined it is best in these instances to include modest overestimates of expected take. By doing this, NMFS gives researchers enough flexibility to make in–season research protocol adjustments in response to annual fluctuations in environmental conditions-such as water flows, larger than expected run sizes, etc.–without having to shut down the research because the expected take was exceeded. Also, high take estimates are useful for NMFS to conservatively analyze the effects of the actions, as it allows accidents that could cause higher–than–expected take to be included in the analysis.

Research permits list general and special conditions to be followed before, during, and after the research activities are conducted. These conditions are intended to: (a) manage the interaction between scientists and ESA–listed salmonids by requiring that research activities be coordinated among permit holders and between permit holders and NMFS; (b) require measures to minimize impacts on target species; and (c) report to NMFS information on the effect the permitted activities have on the species of concern. The following conditions are common to all of the permits. In all cases, the permit holder must:

1. Anesthetize each ESA–listed fish that is handled out–of–water. Anesthetized fish must be allowed to recover (e.g. in a recovery tank) before being released. Fish that are simply counted must remain in water and do not need to be anesthetized.

2. Handle each ESA-listed fish with extreme care and keep them in water to the maximum extent possible during sampling and processing procedures. The holding units must contain adequate amounts of well-circulated water. When using gear that captures a mix of species, ESA-listed fish must be processed first to minimize the duration of handling stress. The transfer of ESA-listed fish must be conducted using a sanctuary net to prevent the added stress of an out-of-water transfer.

3. Stop handling ESA–listed juvenile fish if the water temperature exceeds 70 degrees Fahrenheit at the capture site. Under these conditions, ESA-listed fish may only be identified and counted.

4. Use a sterilized needle for each individual injection when using a passive integrated transponder tag (PIT-tag) to mark ESA-listed fish. This is done to minimize the transfer of pathogens between fish.

5. Notify NMFS in advance of any changes in sampling locations or research protocols, and obtain approval before implementing those changes.

6. Not intentionally kill (or cause to be killed) any ESA–listed species authorized to be taken by the permit, unless the permit allows for lethal take of the ESA–listed species.

7. Exercise due caution during spawning ground surveys to avoid disturbing, disrupting, or harassing ESA–listed adult salmonids when they are spawning. Whenever possible, walking in the stream must be avoided—especially in areas where ESA–listed salmonids are likely to spawn.

8. Use visual observation protocols instead of intrusive sampling methods whenever possible. This is especially appropriate when merely ascertaining whether anadromous fish are present. Snorkeling and streamside surveys will replace electrofishing procedures whenever possible.

9. Comply with NMFS' backpack electrofishing guidelines when using backpack electroshocking equipment to collect ESA-listed fish.

10. Report to NMFS whenever the authorized level of take is exceeded or if circumstances indicate that such an event is imminent. Notification should be made as soon as possible, but no later than two days after the authorized level of take is exceeded. Researchers must then submit a detailed written report. Pending review of these circumstances, NMFS may suspend research activities or reinitiate consultation before allowing research activities to continue.

11. Submit to NMFS a post-season report summarizing the results of the research. The report must include a detailed description of activities, the total number of fish taken at each location, an estimate of the number of ESA-listed fish taken at each location, the manner of take, the dates/locations of take, and a discussion of the degree to which the research goals were met.

Additional permit conditions specific to each of the proposed research are included in the descriptions of the respective permits.

Finally, NMFS will monitor actual annual takes of ESA-listed fish species associated with scientific research activities (as provided to NMFS in annual reports or by other means) and shall adjust annual permitted take levels if they are deemed to be excessive or if cumulative take levels are determined to operate to the disadvantage of the ESA-listed species.

The Individual Permits

The ESA describes take to mean to harass, harm, pursue, hunt, shoot, would, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Each permit action requests to take the threatened species that are the subject of this Opinion. Activities proposed in the permit actions have been classified into the following categories (per the application instructions) and are defined as follows:

1. Observe/harass;
2. Collect for transport (including rescue/salvage);
3. Capture, handle, and release;
4. Capture, handle, tag, mark, tissue sample, and/or other invasive procedure, and release;
5. Direct lethal take (sacrifice);
6. Indirect lethal take (indirect mortality);
7. Removal (e.g., for broodstock collection); and,
8. Other take (any take not described above).

Many of the permit requests described in the following pages seek to take other listed salmonids along with those addressed in this Opinion (e.g., Oregon Coast coho salmon, Snake River sockeye salmon). The effects of taking those other species are described in other biological opinions and are not relevant to this consultation. Therefore, only those portions of the proposed research activities that would affect

UWR chinook salmon, LCR chinook salmon, UWR steelhead, LCR steelhead, and CR chum salmon are discussed here.

Permit 1102:

An amendment to Permit 1102 (modification 1) would authorize the WDFW to annually take adult LCR chinook salmon and LCR steelhead associated with two scientific research studies. The purpose of Study 1 is to determine the number and timing of wild and hatchery steelhead adults that pass Bonneville Dam on the Columbia River. The purpose of Study 2 is to determine the genetic stock identification of anadromous adult fish harvested in Columbia River fisheries including fisheries conducted by Native Americans. The research will benefit LCR chinook salmon and LCR steelhead by providing data that will be used to determine the fishery impacts on ESA–listed stocks and, if possible, to shape fisheries to reduce impacts on ESA–listed or depressed stocks while focusing harvest on healthy stocks. The WDFW proposes to capture (at Bonneville Dam or in the fishery), handle, sample for tissues/scales, release adult fish. For Study 2, tissue samples and scales are collected from ESA-listed adult salmon and steelhead carcasses and transferred to WDFW's Genetic Stock Identification Laboratory and/or NMFS' Northwest Fisheries Science Center for archival and/or analysis. ODFW and CRITFC are also authorized to act as agents of WDFW under Permit 1102. and take tissue samples from carcasses. The WDFW requests take for mortalities that may occur as an indirect result of the research.

Permit 1134:

An amendment to Permit 1134 (modification 1) to research project # 4, would authorize the CRITFC to annually take adult LCR chinook salmon during scientific research efforts associated with Project 4 located at Bonneville Dam. The purpose of this project is to determine the number and timing of wild and hatchery steelhead adults that pass Bonneville Dam on the Columbia River. Research Project 4 will benefit LCR chinook salmon by providing data that may be used to manage dam operations to benefit wild or endangered stocks. The CRITFC proposes to capture (at Bonneville Dam), handle, sample for tissues/scales, and release adult fish.

Permit 1156:

Permit 1156 (modification 1) would authorize the EPA to annually take adult and juvenile UWR chinook salmon, LCR chinook salmon, UWR steelhead, and LCR steelhead associated with research designed to the assess status and trends of surface waters in the Pacific Northwest in a statistically and ecologically rigorous manner as mandated by the Clean Water Act (CWA). The research is designed to collect data used to enforce the CWA which will increase the recovery potential of ESA–listed species in various rivers in the Pacific Northwest. The research will benefit ESA–listed fish by providing baseline information to support enforcement of the CWA in freshwater river systems where ESA–listed fish may be present. Dynamac Corporation is a cooperator with the scientific research and its biologists are authorized to act as agents of EPA in conducting the research. EPA/Dynamac proposes to capture (using backpack or raft–mounted electrofishing), examine, and release juvenile fish; adult fish would be shocked but not netted during the activities. EPA/Dynamac requests take for mortalities that may occur as an indirect result of the research. EPA has also requested that the Washington Department of Ecology and the USGS, Biological Resources Division, be allowed to act as an agents under the permit while conducting the research..

Permit 1140:

Permit 1140 (modification 2) would authorize the NWFSC to annually take juvenile UWR chinook salmon, LCR chinook salmon, UWR steelhead, LCR steelhead, and CR chum salmon associated with research designed to assess the relationship between environmental variables, selected anthropogenic stresses, and bacterial and parasitic pathogens on disease–induced mortality of juvenile salmon in selected coastal estuaries in Oregon and Washington. The results of the study will benefit ESA–listed species by providing a better understanding of how environmental factors influence disease transmission. The project is being coordinated with the pathogen research being conducted by the NWFSC under permit 1290. The NWFSC proposes to capture (using seines and fyke nets), handle, and release or lethally take juvenile fish. The NWFSC also requests take for mortalities that may occur as an indirect result of the research. The dead fish would be retained for research purposes or returned to the river.

Permit 1135:

Permit 1135 would authorize the USGS to annually take adult and juvenile LCR steelhead associated with research designed to provide information on the survival rates, growth rates, habitat use, population densities, fish health, and life–history diversity of steelhead in the Wind River Basin of southern Washington. The research will benefit the listed species by providing information that will assist state, tribal, and Federal managers in their effort to restore LCR steelhead populations and their habitats in the Wind River Basin. The USGS proposes to observe/harass adult and juvenile steelhead during snorkel surveys and during habitat surveys at selected sites in the basin. The USGS also proposes to capture (using backpack electrofishing), handle, sample for tissues/scales, and release or lethally take juvenile fish. The USGS requests take for any fish killed as an indirect result of the research.

Permit 1175:

Permit 1175 would authorize the GPNF to annually take adult and juvenile LCR chinook salmon and steelhead, and adult CR chum salmon during scientific research conducted in streams across the forest. The purpose of the research is to conduct fish distribution and habitat quality surveys across the GPNF and evaluate the biological benefits of habitat improvement projects. The research will benefit ESA–listed fish by yielding information that will be used in broad–scale analyses and project–level planning to protect high–value habitat and restore degraded habitat. GPNF proposes to observe adult fish (during snorkel surveys) and capture (using electrofishing, and seining), handle, and release juvenile fish. GPNF also requests take for mortalities that may occur as an indirect result of the research.

Permit 1252:

Permit 1252 would authorize the WDOT to annually take juvenile LCR chinook salmon, LCR steelhead, and CR chum salmon during presence/absence surveys in waterbodies crossed by or adjacent to state transportation systems (highways, railroads, or airports) in Washington. The surveys would be used to assess potential impacts of WDOT projects on ESA–listed fish species. The survey work will benefit ESA–listed salmonids by providing information that will enable WDOT to implement specific timing restrictions for in–water work windows, and to implement best management practices designed to protect ESA–listed species. The surveys will also add to the knowledge base of where ESA–listed species are located. WDOT proposes to observe/harass (during snorkel surveys) or capture (using dip nets, seines, minnow traps, rod and reel, and electrofishing), handle, and release juvenile fish. WDOT also requests take for mortalities that may occur as an indirect result of the research. WDOT proposes to use passive techniques, such as snorkeling or stream–bank observation, when possible.

Permit 1256:

Permit 1256 would authorize the BLM to annually take adult and juvenile UWR chinook salmon in the upper Willamette and McKenzie Rivers and their tributaries in Oregon State. The purposes of the study are to: (1) Collect data on fish abundance and presence, adult escapement, and habitat needs prior to stream enhancement; (2) evaluate habitat restoration projects; (3) non–salmon species presence, migration time, and smoltification size; and (4) perform watershed analysis. The study would benefit UWR chinook salmon by determining the relative changes in fish habitat due to management projects as compared to natural fluctuations. The BLM proposes to observe fish by snorkeling during habitat and spawning surveys, and capture (using backpack electrofishing, seining, dipnetting, and rotary trapping), handle, and release adult and juvenile salmonids. The BLM also requests take for mortalities that may occur as an indirect result of the research.

Permit 1290:

Permit 1290 would authorize the NWFSC to annually take juvenile UWR chinook salmon, LCR chinook salmon, UWR steelhead, LCR steelhead, and CR chum salmon associated with two scientific research studies in the Columbia River estuary. The purpose of Study 1 is to evaluate the importance of the Columbia River estuary to baitfish populations and salmonid survival. The study will benefit ESA–listed salmonids by providing information on the relative relationship between baitfish abundance and salmonid survival in the estuary and marine environments. The purpose of Study 2 is to determine the prevalence and intensity of pathogens in juvenile salmonids. The research will benefit ESA–listed salmonids by contributing information on the extent to which diseases affect the growth and survival of juvenile salmonids in the estuarine and early ocean environments. This proposed research project is intended to complement the pathogen research that is being conducted by the NWFSC under permit 1140. NWFSC proposes to capture, handle, and release or lethally take juvenile fish. If insufficient samples are obtained in the estuary, NWFSC proposes to obtain fish from the juvenile bypass at Bonneville Dam. NWFSC also requests take for mortalities that may occur as an indirect result of the research. Any fish killed indirectly will be retained for Study 2 in place of intentional lethal takes.

Permit 1291:

The Columbia River Research Laboratory, USGS requests a permit for annual takes of juvenile LCR chinook salmon and juvenile LCR steelhead associated with a scientific research project to be conducted at John Day, The Dalles, and Bonneville Dams on the lower Columbia River in the Pacific Northwest. The purpose of the research is to monitor juvenile fish movement, distribution, behavior, and survival from John Day Dam downstream past Bonneville Dam using radiotelemetry technology. The research will benefit ESA-listed fish species by providing information on spill effectiveness, forebay residence times, and guidance efficiency under various flow regimes that will allow Federal resource managers to make adjustments to bypass/collection structures to optimize downriver migrant survival at the hydropower projects. The proposed research is intended to complement the research that is being conducted by USGS under Research Action 1130 contained in the biological opinion entitled "Reinitiation of Consultation on Operation of the Federal Columbia River Power System, Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin" that was issued on December 21, 2000 (NMFS 2000a). ESA-listed juvenile fish are proposed to be captured by Smolt Monitoring Program (SMP) personnel at Bonneville and/or John Day Dams, sampled for biological information, and released or captured by SMP personnel, provided to USGS personnel, implanted with radio transmitters, transported, held for as long as 24 hours, released, and tracked electronically. USGS requests that SMP personnel be allowed to act as an agent of USGS under the proposed permit. USGS also requests ESA-listed juvenile fish indirect mortalities associated with the research.

Permit 1293:
Permit 1293 would authorize the NRC to annually take juvenile LCR chinook salmon, LCR steelhead, and CR chum salmon during scientific research conducted in numerous headwater streams throughout Oregon and Washington. The purpose of the research is to determine juvenile fish presence or absence on privately owned timberlands and to provide the Washington Department of Natural Resources, the Oregon Department of Forestry, and other state agencies with information to be used to update fish distribution maps. The research will benefit ESA–listed salmonids by providing information on the upper extent of fish usage in headwater streams, providing information on potential stream blockages which may inhibit anadromous fish migration, and providing information that will assist small landowners with culvert projects that could result in an increase in available fish habitat. NRC proposes to observe/harass, capture (using electrofishing and angling), handle, and release juvenile fish. NRC also requests take for mortalities that may occur as an indirect result of the research.

Permit 1312:
Permit 1312 would authorize the ORM to annually take juvenile LCR chinook salmon, LCR steelhead, and CR chum salmon during a scientific research study to be conducted in multiple river basins in western Washington State. The purpose of the study is to determine the presence of ESA-listed and other fish species. The research will benefit listed species by allowing landowners to make informed land management decisions to conserve listed salmonids. ORM proposes to capture (using electrofishing), handle, and release juvenile fish. No fish are expected to be killed during the study.

Permit 1318:
Permit 1318 would authorize the ODFW to annually take juvenile UWR chinook salmon, LCR chinook salmon, UWR steelhead, and LCR steelhead during the course of conducting five separate scientific research projects, four of which may affect the above–listed fish. The purpose of Project 1 is to determine the effects that bank treatment and near-shore development have on anadromous and resident fish in the lower Willamette River. The ODFW proposes to capture, handle, and release juvenile UWR and LCR chinook salmon. These fish will be captured with beach seines and (possibly) by mid-water trawls, gill nets, and boat electrofishing. The ODFW also requests a small amount of indirect lethal take that may be associated with these activities. The project will benefit listed salmon by providing new information on the lower Willamette River ecosystem which, in turn, will help guide future waterway management and development in the Willamette and other river basins. The purpose of Project 2 is to determine trends in warmwater fish communities and answer long-term management questions for warmwater species statewide. The ODFW proposes to capture, handle, and release juvenile UWR and LCR chinook salmon and juvenile UWR and LCR steelhead while conducting boat electrofishing transects in warm- and backwater habitats. The ODFW also requests a small amount of indirect lethal take that may be associated with these activities. The project will benefit listed salmonids by providing information on fish population structures and species interactions that will be used to design and implement management actions that conserve and protect listed species. The purpose of Project 4 is to determine whether spring chinook salmon are naturally reproducing in the Mohawk River system (a tributary to the McKenzie River). The ODFW proposes to capture, handle and release juvenile UWR chinook salmon while conducting boat electrofishing transects and, possibly, seining and backpack electrofishing in the Mohawk River. The ODFW also requests a small amount of indirect lethal take that may be associated

with these activities. The project will benefit listed salmonids by determining if naturally-reproducing populations of chinook salmon have been reestablished in the area, thus allowing managers to take them into account in future decisions. The purpose of Project 5 is to conduct a genetic characterization of rainbow trout in the Coast Fork Willamette, Middle Fork Willamette, and McKenzie River Basins. The ODFW proposes to capture, handle, and release juvenile UWR chinook salmon while conducting boat electrofishing transects for rainbow trout on the McKenzie River. The ODFW also requests a small amount of indirect lethal take that may be associated with these activities. The project will benefit listed salmon by helping document the distribution, abundance, and condition of UWR chinook salmon.

Permit 1322:

Permit 1322 would authorize the NWFSC to annually take juvenile UWR chinook salmon, LCR chinook salmon, UWR steelhead, LCR steelhead, and CR chum salmon in the Lower Columbia River estuary. The purpose of the study is to determine: the presence and abundance of fall and spring chinook salmon, coho salmon, and chum salmon in the estuary and Lower Columbia River; determine the relationship between juvenile salmon and Lower Columbia River estuarine habitat; and obtain information about flow change, sediment input, and habitat availability for the development of a numerical model. The study would benefit listed salmonids by serving as the basis for estuarine restoration and preservation plans for endangered salmonid stocks. The NWFSC proposes to place beach seines at eight sampling sites near the Astoria Bridge and trapnets in four sites in Cathlamet Bay. NWFSC proposes to capture, anesthetize, scan for tags, measure, weigh, and release juvenile salmonids. Up to ten fish of each species at each of the twelve sampling sites would be killed each month for stomach content, scale, and otolith analyses. Any indirect mortalities would be used in place of the intentional lethal takes.

Permit 1326:

Permit 1326 would authorize the CGI to annually take adult and juvenile UWR chinook salmon, LCR chinook salmon, UWR steelhead, and LCR steelhead associated with scientific research to be conducted at Swan Island in the Portland Harbor located in the Lower Willamette River. The purpose of the study is to test a freshwater air screen for use in preventing or minimizing fish entry onto a floating dry dock facility. The research would benefit listed species by determining their presence and testing new methods of moving fish away from dry dock areas during operations thus providing useful information for protecting listed species at dry dock facilities. CGI proposes to capture (using boat electrofishing and intake porthole nets), anesthetize, identify, measure, check for marks, weigh, and release juvenile salmonids. Adult fish that may be encountered would not be netted. CGI also requests take for mortalities that may occur as an indirect result of the research.

Permit 1327:

Permit 1327 would authorize the WWU to annually take adult and juvenile UWR chinook salmon and UWR steelhead on the Willamette and McKenzie Rivers. The purpose of this study is to identify and rank sources of stress in the watershed, create a valid process for differentiation between anthropogenic and natural impacts on streams used as receiving waters associated with pulp and paper mill operation, and make an ecological risk assessment specifically aimed at point/non–point source pollution in the Upper Willamette–Lower McKenzie watershed. The study would benefit UWR chinook salmon and UWR steelhead recovery through ecological assessment and stressor identification in the watershed. WWU proposes to capture (using boat electrofishing), identify, and release juvenile fish. No attempt would be made to net or capture adult listed fish. WWU also requests take for mortalities that may occur as an indirect result of the research.

Permit 1328:

Permit 1328 would authorize the LWG to annually take adult and juvenile UWR chinook salmon, LCR chinook salmon, UWR steelhead, and LCR steelhead during scientific research efforts on the Lower Willamette River. The purpose of the study is to investigate juvenile salmon residence time and distribution and use the data to determine potential exposure of listed fish to contaminated sediment associated with an EPA superfund project. The study would benefit threatened species in the Portland harbor by generating population distribution information that can be used to design a remediation program to minimize sediment impacts, and aid management of future development and conservation of valuable fish habitat. LWG proposes to capture (using boat electrofishing), handle, anesthetize, measure, check for marks and tags, and release juvenile salmonids. Adult fish that may be encountered would not be netted. LWG also requests take for mortalities that may occur as an indirect result of the research.

Permit 1330:

Permit 1330 would authorize Weyerhaeuser to annually take juvenile LCR steelhead in Harrington Creek in the Toutle River Basin, WA. The purpose of the study is to increase understanding of the relationship between aquatic organisms and their habitat, determine how forest management and restoration influence the aquatic ecosystem, and produce reliable scientific data for the development of effective forest management practices that better protect aquatic resources. This research would benefit listed salmonids by producing data on their natural habitat recovery processes and by identifying the effects that various stressors have on listed species. Weyerhaeuser proposes to observe (during snorkeling surveys), capture (using backpack electrofishing), anesthetize, identify, measure, weigh, and release fish for data collection including water typing and population surveys. Weyerhaeuser also requests take for mortalities that may occur as an indirect result of the research.

Permit 1333:

Permit 1333 would authorize OSU to take adult and juvenile UWR chinook salmon, LCR chinook salmon, UWR steelhead, and LCR steelhead in the Willamette River, McKenzie River, and the Columbia River. The purpose of the study is to evaluate floodplain and riparian restoration, test the effectiveness of new assessment tools for conservation planning, and improve aquatic habitat. The study would benefit listed salmonids by helping to determine the actions needed to restore ecological processes in salmon and steelhead habitat. OSU proposes to capture (using boat electrofishing), identify, measure, examine for abnormalities, and release juvenile fish. Adult fish that may be encountered would not be netted. OSU also requests take for mortalities that may occur as an indirect result of the research.

Permit 1334:

Permit 1334 would authorize OREMET to take juvenile UWR chinook salmon and UWR steelhead in the Calapooia River and Oak Creek tributaries to the Willamette River. The purpose of the study is to evaluate stream health and occurrence of juvenile listed salmonids in areas downstream from a titanium plant and to determine the effectiveness of wastewater treatment. The study would benefit listed salmonids by determining if continued treatment of effluent, which provides a consistent perennial flow of water in Oak Creek, sufficiently protects listed salmonids. OREMET proposes to use backpack electrofishing to capture fish which would then be measured, identified, and released. No lethal takes of ESA–listed fish are requested.

Permit 1335:

Permit 1335 would authorize the USFS to take adult and juvenile CR chum salmon in three tributaries of the Columbia River in Washington State. The purpose of the study is to assess watershed conditions and limiting factors, and determine watershed health under the Northwest Forest Plan. The activities would benefit listed fish by providing the USFS with information that will be used to improve forest management and thereby protect listed species. USFS proposes to capture (using backpack electrofishing), anesthetize, measure, and release fish. USFS also requests take for mortalities that may occur as an indirect result of the research. If possible, USFS would consider the use of passive observation techniques such as snorkel surveys to replace electrofishing.

Permit 1336:

Permit 1336 would authorize the PBF to take juvenile UWR chinook salmon, UWR steelhead, LCR chinook salmon, and LCR steelhead in various lakes, rivers, and creeks in the Willamette and Columbia River systems. The purpose of the study is to evaluate factors limiting fish distribution in streams owned by PBF and to determine water quality in those streams. The study would benefit listed fish by producing data that would be used to conserve and restore critical habitat. PBF proposes to capture (using backpack electrofishing and dipnetting), handle, and release juvenile fish. No lethal takes of ESA–listed fish are requested.

Permit 1337:

Permit 1337 would authorize OSU to annually take adult and juvenile UWR chinook salmon and UWR steelhead in Rickreall Creek, Oregon. The purpose of the study is to assess the seasonal composition and distribution of fishes and determine associations of all life stages of fish with available habitat, level of disturbance, and hydrological patterns. The study would benefit listed salmonids by generating data that would help improve creek management. OSU proposes to capture (using dipnetting, beach seining, fyke and hoop netting, backpack electrofishing, angling, and trammel netting), handle, and release adult and juvenile fish. OSU also requests take for mortalities that may occur as an indirect result of the research.

Permit 1338:

Permit 1338 would authorize the USFWS to annually take adult and juvenile LCR chinook salmon, LCR steelhead, and CR chum salmon during scientific research efforts in Hardy Creek, Hamilton Springs, and the mainstem Columbia River. The purposes of the study are to: (1) examine factors limiting chum salmon production; (2) enhance and restore chum salmon production; (3) evaluate nearby tributaries for restoration; and (4) evaluate the relationship between mainstem Columbia River and tributary chum salmon populations. The study would benefit listed chum salmon by providing information on their freshwater life history that can be used in Columbia River water management and recovery planning. Adult listed fish are proposed to be captured (by seine, weir, or tangle net), anesthetized, bio–sampled, marked and/or tagged, and released. Juvenile listed fish are proposed to be captured (by fyke net, weir, or screw trap), marked using a photonic dye injector or Bismark Brown Y (a temporary dye), and released. USFWS also requests take for mortalities that may occur as an indirect result of the research.

The Action Area

The proposed actions considered in this Opinion may affect five threatened species: UWR chinook salmon, LCR chinook salmon, UWR steelhead, LCR steelhead, and CR chum salmon—including the species' designated critical habitat (NOAA 2000). Critical habitat consists of the water, substrate, and adjacent riparian zone of estuarine and riverine reaches in hydrologic units and counties identified in February 16, 2000, 65 FR 7764 (NOAA 2000): Table 9 for UWR chinook salmon; Table 8 for LCR chinook salmon; Table 14 for CR chum salmon; Table 23 for UWR steelhead; and Table 22 for LCR steelhead. Accessible reaches are those within the historical range of the ESUs that can still be occupied by any life stage of salmon or steelhead. Some of the actions considered in this Opinion would be conducted in specific stream sites while others are more broadly based and would take place in various streams throughout Oregon and Washington.

UWR chinook salmon

The action area is defined as the geographic extent of all direct and indirect effects of a proposed agency action [50 C.F.R. 402.02 and 402.14(h)(2)]. For the purposes of this Opinion, the action area includes all rivers, streams, and their tributaries accessible to listed spring-run chinook salmon in the Clackamas River and in the Willamette River, and its tributaries, above Willamette Falls, Oregon.

Critical habitat is designated to include all river reaches accessible to listed chinook salmon in the Clackamas River and the Willamette River and its tributaries above Willamette Falls. Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to and including the Willamette River in Oregon. Excluded are tribal lands and areas above specific dams (NOAA 2000, Table 9) or above longstanding, naturally–impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 8,575 square miles. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon–Benton, Clackamas, Clatsop, Columbia, Douglas, Lane, Lincoln, Linn, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill; Washington–Clark, Cowlitz, Pacific, and Wahkiakum. More detailed critical habitat information (i.e., specific watersheds, migration barriers, habitat features, and special management considerations) for this ESU can be found in the February 16, 2000 Federal Register notice (NOAA 2000).

LCR chinook salmon

The action area is defined as the geographic extent of all direct and indirect effects of a proposed agency action [50 C.F.R. 402.02 and 402.14(h)(2)]. For the purposes of this Opinion, the action area includes all rivers, streams, and their tributaries accessible to naturally spawned populations of chinook salmon from the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, and includes the Willamette River to Willamette Falls, Oregon, exclusive of spring-run chinook salmon in the Clackamas River.

Critical habitat is designated to include all river reaches accessible to listed chinook salmon in Columbia River tributaries between the Grays and White Salmon Rivers in Washington and the Willamette and Hood Rivers in Oregon, inclusive. Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to The Dalles Dam. Excluded are tribal lands and areas above specific dams (NOAA 2000, Table 8) or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 6,338 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon−Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, Wasco, and Washington; Washington−Clark, Cowlitz, Klickitat, Lewis, Pierce, Pacific, Skamania, Wahkiakum, and Yakima. More detailed critical habitat information (i.e., specific watersheds, migration barriers, habitat features, and special management considerations) for this ESU can be found in the February 16, 2000 Federal Register notice (NOAA 2000).

UWR steelhead

The action area is defined as the geographic extent of all direct and indirect effects of a proposed agency action [50 C.F.R. 402.02 and 402.14(h)(2)]. For the purposes of this Opinion, the action area includes all rivers, streams, and their tributaries accessible to naturally spawned populations of winter-run steelhead in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to the Calapooia River, inclusive.

Critical habitat is designated to include all river reaches accessible to listed steelhead in the Willamette River and its tributaries above Willamette Falls upstream to, and including, the Calapooia River. Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to, and including, the Willamette River in Oregon. Excluded are tribal lands and areas above specific dams (NOAA 2000, Table 23) or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 4,872 square miles in Oregon. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon−Benton, Clackamas, Clatsop, Columbia, Lincoln, Linn, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill; Washington−Clark, Cowlitz, Pacific, and Wahkiakum. More detailed critical habitat information (i.e., specific watersheds, migration barriers, habitat features, and special management considerations) for this ESU can be found in the February 16, 2000 Federal Register notice (NOAA 2000).

LCR steelhead

The action area is defined as the geographic extent of all direct and indirect effects of a proposed agency action [50 C.F.R. 402.02 and 402.14(h)(2)]. For the purposes of this Opinion, the action area includes all rivers, streams, and their tributaries accessible to naturally spawned populations of steelhead (and their progeny) in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive) and the Willamette and Hood Rivers, Oregon (inclusive). Excluded are steelhead in the upper Willamette River Basin above Willamette Falls and steelhead from the Little and Big White Salmon Rivers in Washington State.

Critical habitat is designated to include all river reaches accessible to listed steelhead in Columbia River tributaries between the Cowlitz and Wind Rivers in Washington and the Willamette and Hood Rivers in Oregon, inclusive. Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to the Hood River in Oregon. Excluded are tribal lands and areas above specific dams (NOAA 2000, Table 22) or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 5,017 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon−Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, and Washington; Washington−Clark, Cowlitz, Lewis, Pacific, Skamania, and Wahkiakum. More detailed critical habitat information (i.e., specific watersheds, migration barriers, habitat features, and special management considerations) for this ESU can be found in the February 16, 2000 Federal Register notice (http://www.nwr.noaa.gov/1salmon/salmesa/fedreg.htm).

CR chum salmon

The action area is defined as the geographic extent of all direct and indirect effects of a proposed agency action [50 C.F.R. 402.02 and 402.14(h)(2)]. For the purposes of this Opinion, the action area includes all rivers, streams, and their tributaries accessible to naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon.

Critical habitat is designated to include all river reaches accessible to listed chum salmon (including estuarine areas and tributaries) in the Columbia River downstream from Bonneville Dam, excluding Oregon tributaries upstream of Milton Creek at river km 144 near the town of St. Helens. Also included are adjacent riparian zones. Excluded are tribal lands and areas above specific dams (NOAA 2000, Table 14) or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 4,426 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon−Clatsop, Columbia, Multnomah, and Washington; Washington−Clark, Cowlitz, Lewis, Pacific, Skamania, and Wahkiakum. More detailed critical habitat information (i.e., specific watersheds, migration barriers, habitat features, and special management considerations) for this ESU can be found in the February 16, 2000 Federal Register notice (NOAA 2000).

STATUS OF THE SPECIES UNDER THE ENVIRONMENTAL BASELINE

In order to describe a species' status, it is first necessary to define precisely what "species" means in this context. Traditionally, one thinks of the ESA listing process as pertaining to entire species of animals or plants. While this is generally true, the ESA also recognizes that there are times when the listing unit must necessarily be a subset of the species as a whole. In these instances, the ESA allows a "distinct population segment" (DPS) of a species to be listed as threatened or endangered.

NMFS developed the approach for defining salmonids DPSs in 1991 (Waples 1991). It states that a population or group of populations is considered a distinct population segment if they are "...substantially reproductively isolated from conspecific populations," and if they are considered "...an important component of the evolutionary legacy of the species." A distinct population or group populations is referred to as an evolutionarily significant unit (ESU) of the species. All of the ESUs addressed in this Opinion are considered DPSs and hence–"species"–under the ESA.

The threatened salmonids identified in the section above were listed under the ESA because NMFS determined that a number of factors, both environmental and demographic, had caused them to decline to the point where they were likely to be in danger of going extinct within the foreseeable future. The factors for decline affect biological salmonid requirements at every life stage and arise from a number of different sources. This section of the Opinion explores those effects and defines the context within which they occur.

Life Histories:

Chinook Salmon

Chinook salmon are the largest of the Pacific salmon. The species' North American distribution historically ranged from the Ventura River in California to Point Hope, Alaska. In northeastern Asia the species from Hokkaido, Japan to the Anadyr River in Russia (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, chinook salmon exhibit the most diverse and complex life–history strategies. (Healey 1986) described 16 age categories for chinook salmon, seven total ages at maturity with three possible freshwater ages. (Gilbert 1912) initially described two general freshwater life-history types: "stream-type" chinook salmon reside in fresh water for a year or more following emergence; "ocean-type" chinook salmon migrate to the ocean within their first year.

The generalized life history of Pacific salmon includes phases of incubation, hatching, freshwater emergence, migration to the ocean, and subsequent initiation of maturation and return to fresh water for completion of maturation and spawning. Juvenile rearing in fresh water can be minimal or extended. Additionally, some male chinook salmon mature in fresh water, thereby foregoing emigration to the ocean. The timing and duration of each of these stages is related to varying degrees of genetic and environmental determinants and interactions thereof. More detailed descriptions of the key features of chinook salmon life history can be found in (Myers, et al. 1998 and Healey 1991).

Chinook salmon in the UWR and LCR ESUs exhibit both "ocean type" and "stream type" life histories. Populations tend to mature at ages 3 and 4. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas throughout the range of the ESU. Parr undergo a smolt transformation as subyearlings or yearlings in the spring at which time they migrate to the ocean. Subadults and adults forage in coastal and offshore waters of the North Pacific Ocean prior to returning to spawn in their natal streams. Adult spring-run chinook salmon typically return to fresh water in April and May and spawn in August and September, while fall-run fish begin to return in August and spawn from late September through January.

UWR ESU

The UWR chinook salmon ESU includes native spring-run populations above Willamette Falls and in the Clackamas River. Historically, it included sizable numbers of spawning salmon in the Santiam River, the middle fork of the Willamette River, and the McKenzie River, as well as smaller numbers in the Molalla River, Calapooia River, and Abiqua Creek. UWR chinook salmon mature in their fourth or fifth years. Historically, 5-year-old fish dominated the spawning migration runs. Recently, however, most fish have matured at age 4. Fish in this ESU are distinct from those of adjacent ESUs in life history and marine distribution. The life history of UWR chinook salmon includes traits from both ocean- and stream-type developmental strategies. Coded-wire-tag (CWT) recoveries indicate that the fish travel to the marine waters off British Columbia and Alaska. More Willamette River chinook salmon are recovered in Alaskan waters than those from the LCR ESU. The timing of the spawning migration is limited by Willamette Falls. High flows in the spring allow access to the Upper Willamette basin, whereas low flows in the summer and autumn prevent later-migrating fish from ascending the falls. The low flows may serve as an isolating mechanism, separating this ESU from others nearby.

LCR ESU

The LCR chinook ESU is characterized by numerous short- and medium-length rivers that drain the coast ranges and the west slope of the Cascade Mountains. This ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. The former location of Celilo Falls (drowned by The Dalles reservoir in 1960) is the eastern boundary for this ESU. Stream-type, spring-run chinook salmon found in the Klickitat River or the introduced Carson spring-chinook salmon strain are not included in this ESU. Spring-run chinook salmon in the Sandy River have been influenced by spring-run chinook salmon introduced from the Willamette River ESU. However, analyses suggest that considerable genetic resources still reside in the existing population (Myers et al. 1998). Tule fall chinook salmon from the LCR chinook salmon ESU were observed spawning in the Ives Island area along the Washington shoreline approximately two miles below Bonneville Dam during October of 1999. Most fall-run fish in the LCR chinook salmon ESU emigrate to the marine environment as sub-yearlings (Reimers and Loeffel 1967, Howell et al. 1985, WDF et al. 1993). Returning adults that emigrated as yearling smolts may have originated from the extensive hatchery programs in the ESU. It is also possible that modifications in the river environment have altered the duration of freshwater residence. CWT recoveries of Lower Columbia River ESU fish suggest a northerly migration route, but the fish contribute more to fisheries off British Columbia and Washington than to the Alaskan fishery. Tule fall chinook salmon return at adult ages 3 and 4, “bright” fall chinook salmon return at ages 4, 5, and 6.

Steelhead

Steelhead can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner et al. 1992). The stream-maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in fresh water to mature and spawn. The ocean-maturing type, or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variation in migration timing exists between populations. Some river basins have both summer and winter steelhead, others have only one run type. In the Pacific Northwest, summer steelhead enter freshwater between May and October (Busby et al. 1996, Nickelson et al. 1992). During summer and fall, before spawning, they hold in cool, deep pools (Nickelson et al. 1992). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn (Meehan and Bjornn 1991, Nickelson et al. 1992). Winter steelhead enter freshwater between November and April in the Pacific Northwest (Busby et al. 1996, Nickelson et al. 1992), migrate to spawning areas, and then spawn in late winter or spring. Unlike Pacific salmon, steelhead are capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females (Nickelson et al. 1992). Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation during that time. Depending on water temperature, steelhead eggs may incubate for 1.5 to four months before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity—primarily in the form of large and small woody debris. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992). Juveniles rear in freshwater from one to four years, then migrate to the ocean as smolts. Winter steelhead populations generally smolt after two years in freshwater (Busby et al. 1996). Steelhead typically reside in marine waters for two or three years before returning to their natal stream to spawn at four or five years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby et al. 1996). The age structure appears to be similar to other west coast steelhead—dominated by 4-year-old spawners (Busby et al. 1996). Based on purse–seine catches, juvenile steelhead tend to migrate directly offshore during their first summer, in contrast to salmon which migrate along the coastal belt. Oregon steelhead tend to be north-migrating (Nicholas and Hankin 1988, Pearcy et al. 1990, Pearcy 1992).

UWR ESU

The UWR steelhead ESU occupies the Willamette River and tributaries upstream of Willamette Falls, extending to and including the Calapooia River. These major river basins containing spawning and rearing habitat comprise more than 12,000 km in Oregon. Rivers that contain naturally spawning winter-run steelhead include the Tualatin, Molalla, Santiam, Calapooia, Yamhill, Rickreall, Luckiamute, and Mary's, although the origin and distribution of steelhead in a number of these basins is being debated. Early migrating winter and summer steelhead have been introduced into the Upper Willamette River basin, but those components are not part of the ESU. In general, native steelhead of the Upper Willamette River basin are the late-migrating winter variety entering freshwater primarily in March and April. This atypical run timing appears to be an adaptation for ascending Willamette Falls, which functions as an isolating mechanism for UWR steelhead. Reproductive isolation resulting from the falls may explain the genetic distinction between steelhead from the Upper Willamette River basin and those in the lower river. UWR late-migrating steelhead are ocean-maturing fish. Most return at age 4, with a small proportion returning as 5-year-olds (Busby et al. 1996).

LCR ESU

The Lower Columbia River ESU encompasses all steelhead runs in tributaries between the Cowlitz and Wind Rivers on the Washington side of the Columbia River, and the Willamette and Hood Rivers on the Oregon side. The populations of steelhead that make up the Lower Columbia River ESU are distinguished from adjacent populations by genetic and habitat characteristics. The ESU consists of summer and winter coastal steelhead runs in the tributaries of the Columbia River as it cuts through the Cascades. These populations are genetically distinct from inland populations (east of the Cascades), as well as from steelhead populations in the Upper Willamette River basin and coastal runs north and south of the Columbia River mouth. The following runs are not included in the ESU: the Willamette River above Willamette Falls (Upper Willamette River ESU), the Little and Big White Salmon rivers (Middle Columbia River ESU), and runs based on four imported hatchery stocks (early-spawning winter Chambers Creek/Lower Columbia River mix, summer run Skamania Hatchery stock, winter Eagle Creek NFH stock, and winter run Clackamas River ODFW stock) (NOAA 1998). This area has at least 36 distinct runs (Busby et al.1996), 20 of which were identified in the initial listing petition. In addition, numerous small tributaries have historical reports of fish, but no current abundance data. The major runs in the ESU for which there are estimates of run size, are the Cowlitz River winter runs, Toutle River winter runs, Kalama River winter and summer runs, Lewis River winter and summer runs, Washougal River winter and summer runs, Wind River summer runs, Clackamas River winter and summer runs, Sandy River winter and summer runs, and Hood River winter and summer runs.

Chum Salmon

Historically, chum salmon were distributed throughout the coastal regions of western Canada and the United States, as far south as Monterey Bay, California. Presently, major spawning populations are found only as far south as Tillamook Bay on the northern Oregon coast. Chum salmon spawn primarily in freshwater and, apparently, exhibit obligatory anadromy (there are no recorded landlocked or naturalized freshwater populations Randall et al. 1987). Chum salmon spend more of their life history in marine waters than do other Pacific salmonids. Chum salmon, like pink salmon, usually spawn in the lower reaches of rivers, with redds usually dug in the mainstem or in side channels of rivers from just above tidal influence to nearly 100 km from the sea. Juveniles outmigrate to seawater almost immediately after emerging from the gravel (Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., coastal cutthroat trout, steelhead, coho salmon, and most types of chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions (unlike stream-type salmonids which depend heavily on freshwater habitats) than on favorable estuarine conditions. Another behavioral difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation (Pitcher 1986), especially if their movements are synchronized to swamp predators (Miller and Brannon 1982).

CR chum salmon

Chum salmon from the CR ESU spawn in tributaries and in mainstem spawning areas below Bonneville Dam, most often on the Washington side of the Columbia River (Johnson et al. 1997). Chum salmon enter the Columbia River from mid-October through early December and spawn from early November to late December. Recent genetic analysis of fish from Hardy and Hamilton Creeks and from the Grays River indicate that these fish are genetically distinct from other chum salmon populations in Washington (Salo 1991, WDF et al. 1993, and Johnson et al. 1997).

Overview Status of the Species Under Consultation

To determine a species' status under extant conditions (usually termed "the environmental baseline"), it is necessary to ascertain the degree to which the species' biological requirements are being met at that time and in that action area. For the purposes of this consultation, the biological requirements of these threatened ESUs are expressed in two ways: population parameters such as fish numbers, distribution, and trends throughout the action area; and the condition of various essential habitat features such as water quality, substrate condition, and food availability. Clearly, these two types of information are interrelated. That is, the condition of a given habitat has a large impact on the number of fish it can support. Nonetheless, it is useful to separate the species' biological requirements into these parameters because doing so provides a more complete picture of all the factors affecting the survival of listed fish. Therefore, the discussion to follow will be divided into two parts: Species Distribution and Trends; and Factors Affecting the Environmental Baseline.

Species Distribution and Trends

UWR Chinook Salmon

There are no direct estimates of the size of the chinook salmon runs in the Willamette River basin before the 1940s. McKernan and Mattson (1950) present anecdotal information that the Native American fishery at Willamette Falls may have yielded 2,000,000 lb (908,000 kg) of salmon (a run size of 454,000 fish, each weighing 20 lb). Based on egg collections at salmon hatcheries, Mattson (1948) estimates that the spring chinook salmon run in the 1920s may have been five times the run size of 55,000 fish in 1947, or 275,000 fish. Much of the early information on salmon runs in the Upper Willamette River basin comes from operation reports of state and Federal hatcheries. Although the total number of fish returning to the Willamette has been relatively high (24,000), recent natural escapement is less than 5,000 fish and has been declining sharply. Furthermore, it is estimated that about two-thirds of the natural spawners are first-generation hatchery fish, suggesting that the natural population growth rate is well below replacing itself. The McKenzie River supports the only remaining naturally reproducing population in the ESU (ODFW 1998d). NMFS estimate 2,523 adults will return to spawn this year.

NMFS chinook salmon status review, concluded that chinook salmon in this ESU are not presently in danger of extinction but are likely to become so in the foreseeable future and noted a similarity between population dynamic parameters of UWR chinook salmon and those for the Upper Columbia River steelhead ESU, which was recently listed as endangered by NMFS.

The introduction of fall-run chinook salmon into the basin and the laddering of Willamette Falls have increased the potential for genetic introgression between wild spring- and hatchery fall-run chinook salmon, but there is no direct evidence of hybridization between these two runs. The proximate sources of risk to chinook salmon in this ESU are habitat blockages of large areas of important spawning and rearing habitat by dam construction. Remaining habitat has been degraded by effects of damming, forestry practices, agriculture, and urbanization. Another concern for this ESU is that levels of commercial and recreational harvest are high relative to the apparent productivity of natural populations. (Myers et al 1998)

LCR Chinook Salmon

Recent adult return data for this ESU is summarized in NMFS' biological opinion on the operation of the Federal Columbia River Power System (NMFS 2000a). Historical records of chinook salmon abundance are sparse, but cannery records suggest a peak run of 4.6 million fish in 1883. Although fall-run chinook salmon are still present throughout much of their historical range, most of the fish spawning today are first-generation hatchery strays. Furthermore, spring-run populations have been severely depleted throughout the ESU and extirpated from several rivers.

In 1998, NMFS reassessed the status of this ESU (Meyers et. al 1998) which concluded that chinook salmon in this ESU are not presently in danger of extinction but are likely to become so in the foreseeable future. Updated abundance information illustrated that smaller tributary streams in the range of this ESU support naturally spawning spring run chinook salmon numbering only in the hundreds of fish, while larger tributaries (e.g., Cowlitz River basin) contain natural spring–run chinook salmon ranging in size from 100 to 1,000 fish. Apart from the relatively large and apparently healthy fall-run population in the Lewis and Cowlitz Rivers, production in this ESU appears to be predominantly hatchery-driven with few identifiable native, naturally reproducing populations. Long- and short-term trends in abundance of individual populations are negative, some severely so. About half of the populations comprising this ESU are very small, increasing the risks of extirpation due to genetic and demographic processes. Numbers of naturally spawning spring-run chinook salmon are very low, and native populations in the Sandy and Clackamas Rivers have been supplanted by spring-run fish from the Upper Willamette River. There have been at least six documented extinctions of populations in this ESU, and it is possible that extirpation of other native populations has occurred but has been masked by the presence of naturally–spawning hatchery fish.

Freshwater habitat in the range of LCR chinook salmon is in poor condition in many basins, with problems related to forestry practices, urbanization, and agriculture. Dam construction on the Cowlitz, Lewis, White Salmon, and Sandy Rivers has eliminated access to a substantial portion of the spring-run spawning habitat, with a lesser impact on fall-run habitat. (Myers et al 1998)

UWR Steelhead

Recent adult return data for this ESU are summarized in NMFS' biological opinion on the operation of the FCRPS (NMFS, 2000a). Native winter steelhead within this ESU have been declining since 1971 and have exhibited large fluctuations in abundance.
In 1997, NMFS reassessed the status of this ESU (NMFS 1997). Updated counts of winter steelhead adults above Foster Dam through 1997 showed very low numbers of spawning adults (131-311 naturally-produced fish). Run reconstructions for winter steelhead in the Molalla, North Santiam, and South Santiam Rivers indicate moderate sized runs in these streams (850-1,200 adults). In addition, spawner abundance estimates in the Calapooia River indicate that spawners in this basin have recently reached record lows.

The NMFS 1996 steelhead status review, states that the small numbers and declining trend in the native stock, coupled with other risk factors, indicate risk of becoming endangered. While historical information regarding this ESU is lacking, geographic range and historical abundance are believed to have been relatively small compared to other ESUs, and current production probably represents a larger proportion of historical production than is the case in other Columbia River Basin ESUs.

Native winter–run steelhead within this ESU have been declining since 1971, and have exhibited large fluctuations in abundance. The main production of native (late-run) winter steelhead is in the North Fork Santiam River, where estimates of hatchery fish composition range from 14% to 54% of the total natural spawners. There is strong concern about the pervasive opportunity for genetic introgression from hatchery stocks within the ESU, and strong concern for potential ecological interactions (e.g., competition and predation) between introduced stocks and native stocks. There is widespread production of hatchery steelhead within the range of this ESU, predominantly of non-native summer and early-run winter steelhead.

LCR Steelhead

Recent adult return data for this ESU are summarized in NMFS' biological opinion on the operation of the FCRPS (NMFS 2000a). For the larger runs, (Cowlitz, Kalama, and Sandy Rivers), current counts have been in the range of 1,000 to 2,000 fish. Historical counts for these runs, however, were more than 20,000 fish. In general, all the runs in the ESU have declined over the past 20 years, exhibiting sharp declines in the last five years. Escapement estimates for the steelhead fishery in the LCR ESU are based on in–river and estuary sport-fishing reports; (there is also a limited ocean fishery on this ESU). Harvest rates range from 20% to 50% of the total run, but harvest rates on naturally–produced fish have dropped to 0% to 4% in recent years (punch card data from WDFW through 1994).

The NMFS 1996 steelhead status review, concluded that the LCR steelhead ESU is not presently in danger of extinction, but it is likely to become endangered in the foreseeable future. The majority of stocks for which we have data within this ESU have been declining recently, but some have shown strong increases. However, the strongest upward trends are those of either non-native stocks (Lower Willamette River and Clackamas River summer steelhead) or stocks that are recovering from major habitat disruption and are still at low abundance (mainstem and North Fork Toutle River). The data series for most stocks are quite short, so the preponderance of downward trends may reflect a general coastwide decline in steelhead abundances in recent years. There is strong concern about genetic introgression from hatchery stocks within the ESU, as well as for the status of summer steelhead in this ESU. There is widespread production of hatchery steelhead within this ESU, and several stocks for which we have hatchery composition estimates average more than 50% hatchery fish in natural escapement. Concerns about hatchery influence are especially strong for summer steelhead and Oregon winter steelhead stocks, where there appears to be substantial overlap in spawning between hatchery and natural fish.

The major area of uncertainty in this evaluation is the degree of interaction between hatchery and natural stocks within the ESU. WDFW's conclusion that there is little overlap in spawning between natural and hatchery stocks of winter steelhead throughout the ESU is generally supported by available evidence. However, with the exception of detailed studies of the Kalama River winter stock, it is based largely on models with assumed run times rather than empirical data. There is apparently strong overlap in spawning between hatchery and natural summer steelhead in tributaries on the Washington side of the lower Columbia River. We have no information regarding potential spawning separation between hatchery and natural fish in Oregon tributaries of the lower Columbia River (Busby et al. 1996).

CR Chum Salmon

Recent adult return data for this ESU are summarized in NMFS' biological opinion on the operation of the FCRPS (NMFS 2000a). Previously, chum salmon were reported in almost every river in the lower Columbia River basin, but most runs disappeared by the 1950s (Rich 1942, Marr 1943, Fulton 1970). Historically, the CR chum salmon ESU supported a large commercial fishery landing more than 500,000 fish per year. Commercial catches declined beginning in the mid-1950s. There are now no recreational or directed commercial fisheries for chum salmon in the Columbia River, although chum salmon are taken incidentally in the gill-net fisheries for coho and chinook salmon, and some tributaries have a minor recreational harvest. The estimated minimum run size for the CR chum salmon ESU has been relatively stable, although at a very low level, since the run collapsed during the mid-1950s. Current abundance is probably less than 1% of historical levels, and the ESU has undoubtedly lost some (perhaps much) of its original genetic diversity. Currently, the WDFW regularly monitors only a few natural populations in the basin: one in the Grays River; two in small streams near Bonneville Dam; and one in the mainstem area next to one of the latter two streams. Hatchery fish have had little influence on the naturally–produced component of the CR chum salmon ESU.

Because of the well-known aversion of chum salmon to surmounting in-river obstacles to migration, the effects of the mainstem Columbia River hydropower system have probably been more severe for chum salmon than for other salmon species. Bonneville Dam presumably continues to impede the recovery of upriver populations. Substantial habitat loss in the Columbia River estuary and associated areas presumably was an important factor in the decline and also represents a significant continuing risk for this ESU.

Conclusion

The degree to which each of these ESU's biological requirements are being met, with respect to population numbers and distribution, is decreasing. While some improvement can be seen throughout a given ESU as a whole, (e.g. CR chum salmon and UWR steelhead), critical sub-basins continue to exhibit declining trends. Therefore, while there is some cause for optimism, there has been continued decline in the status of each of these five ESUs since they were listed and their biological requirements are not being met with respect to abundance, distribution, and overall population trend.

Factors Affecting the Environmental Baseline

Environmental baselines for biological opinions are defined by regulation at 50 CFR 402.02, which states that an environmental baseline is the physical result of all past and present state, Federal, and private activities in the action area along with the anticipated impacts of all proposed Federal projects in the action area (that have already undergone formal or early section 7 consultation). The environmental baseline for *this* biological opinion is therefore the result of the impacts a great many activities (summarized below) have had on the survival and recovery of the listed salmonids under this biological opinion. Put another way (and as touched upon previously), the baseline is the culmination of the effects that multiple activities have had on the species' *biological requirements* and, by examining those individual effects, it is possible to derive the species' status in the action area.

Many of the biological requirements for UWR chinook salmon, LCR chinook salmon, UWR steelhead, LCR steelhead, and CR chum salmon in the action area can best be expressed in terms of the essential features of their critical habitat. That is, the salmonids require adequate: (1) substrate (especially spawning gravel); (2) water quality; (3) water quantity; (4) water temperature; (5) water velocity; (6) cover/shelter; (7) food; (8) riparian vegetation; (9) space, and (10) migration conditions (NOAA 2000).

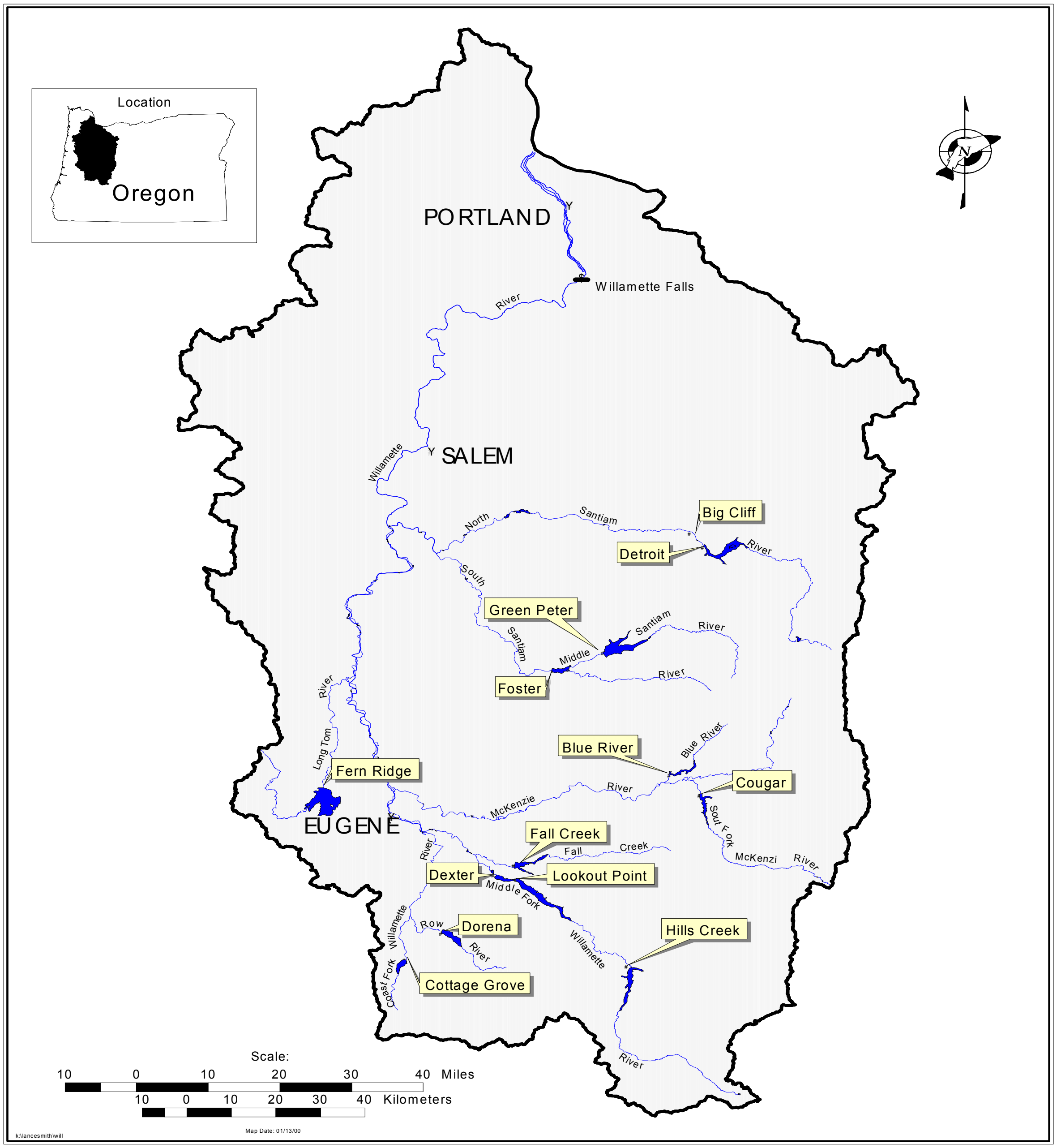
The best scientific information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of west coast salmonids by adversely affecting these essential habitat features. NMFS reviewed much of that information in its recent Consultation on Operation of FCRPS (NMFS 2000a). That review is summarized in the sections below.

It is important to note that while the discussion below may not specifically address each ESU covered in this Biological Opinion, it is simply a case of there being more data on how the various factors for decline have affected some species such as UWR chinook salmon than exist for other ESUs discussed in this Opinion. The reason is that some of the ESUs were listed more recently, for example CR chum salmon. As a result, more studies have been done on how the various factors for decline affect species that were listed further in the past. Nonetheless, even though there may not be as much data on some of the ESU's, it can be conclusively stated that the factors affecting every other salmonid species in the Columbia and Willamette River basins affect the ESUs considered here as well. Therefore, in every instance cited below—whether hydropower development or habitat destruction or any other factor—it can be said UWR chinook salmon, LCR chinook salmon, UWR steelhead, LCR steelhead, and CR chum salmon have all suffered negative effects similar to those described for the species studied.

<u>The Hydropower System</u>

Hydropower development in the Willamette and Columbia basins has dramatically affected anadromous salmonids. Storage dams have eliminated spawning and rearing habitat, altered the natural hydrograph of the Willamette and Columbia Rivers—decreased spring and summer flows, and increasing fall and winter flows. Fluctuations in river flow and elevation caused by hydropower operations can impact fish movements patterns, alter riparian ecology, and strand fish in shallow areas. There are some 371 dams in the Willamette basin alone (Allen et al, 1999), 13 of which are major U.S. Army Corps of Engineers projects The Willamette Project, shown on page 46) in salmonid migration corridors that kill smolts and adults and alter migration patterns and behaviors. The dams in the upper Willamette River have concerted once-swift river reaches into slow-moving reservoirs, thus slowing the smolts' journey to the ocean and creating habitat for predators.

The Willamette Project



Location
Oregon
PORTLAND
Willamette Falls
River
SALEM
Willamette
North
Santiam
Big Cliff
Detroit
River
South
Green Peter
Santiam
River
Santiam
Middle
River
Foster
River
Long Tom
Fern Ridge
Blue River
Blue River
Cougar
EUGENE
McKenzie
River
Fall Creek
Fall
Creek
South Fork
McKenzi
River
River
Dexter
Lookout Point
Middle Fork
Willamette
Row
Dorena
River
Willamette
Hills Creek
Coast Fork
Cottage Grove
River
Scale:
10 0 10 20 30 40 Miles
10 0 10 20 30 40 Kilometers

UWR chinook salmon and steelhead navigate many major hydroelectric projects during their up- and downstream migrations. In contrast, LCR chinook salmon, steelhead, and CR chum salmon only have to navigate Bonneville dam and are still impacted by upstream dam operations. For example, because of the well-known aversion of chum salmon to surmounting in-river obstacles to migration, the effects of the mainstem Columbia River hydropower system have probably been more severe for chum salmon than for other salmon species. Bonneville Dam presumably continues to impede recovery of upriver populations (Johnson et al. 1997) and populations down river suffer from fluctuations in flow that often make spawning habitat inaccessible.

However, ongoing biological opinions between NMFS and the Bonneville Power Administration (BPA), the U.S. Army Corps of Engineers (USACE), the USFWS, and the Bureau of Reclamation (BOR) have brought about numerous beneficial changes in the operation and configuration of the Willamette River hydropower system. For example, increased spill at the dams allows smolts to avoid both turbine intakes and bypass systems; increased flow in the mainstem Willamette and Columbia Rivers provides better inriver conditions for smolts; and better smolt transportation, through the addition and modification of barges in the Columbia River.

Several non-Federal projects also affect listed fish. For example, the Eugene Water and Electric Board (EWEB) operate the Carmen and Trail Bridge Dams on the Upper McKenzie River, Smith Dam on the Smith River, and Leaburg Dam on the lower McKenzie River. The operation of such hydropower projects harm listed ESUs and must offer some form of mitigation or benefit to the effected salmonids. For example, Congress authorized the construction, operation, and maintenance of hatcheries in cooperation with state and federal fisheries agencies to mitigate for fish losses due to construction of the 13 upper Willamette River dams. Hatcheries and provision of fish passage at selected facilities are the primary forms of mitigation. Maintenance of instream flows downstream of projects is another form of mitigation. Significant future improvements are expected to occur as a result of USACE's water temperature control (WTC) study (USACE 2000). The purpose of the WTC study was to evaluate the feasibility of modifying dam facilities to restore downstream water temperatures closer to pre-dam levels. It is hoped that this and future actions will improve salmon survival, and offset the negative effects of hydropower development.

Human-Induced Habitat Degradation

The quality and quantity of freshwater habitat in much of the Columbia River Basin , including the Willamette sub-basin, have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydropower development, mining, and urban development have radically changed the historical habitat conditions of the basin. With the exception of fall chinook salmon, which generally spawn and rear in the mainstem rivers, salmon and steelhead spawning and rearing habitat is found in the tributaries to the Columbia and Willamette Rivers.

A major player in salmonid habitat degradation, urban development in the Willamette Valley followed agriculture which was also damaging. Ninety-six percent of Oregon's population resided in Portland in the 1850s. By the 1930's there were twenty-one incorporated cities in the valley, (Macdonald 1999, Hulse 1998). By the 1990's, there were over 70 incorporated cities, and human population density throughout most of the valley exceed 37/mi. In the Metro region, there are an estimated total of 8,840 structures in or close to the floodplain, and approximately 1,080 household units were built in or close to the floodplain between 1992 and 1995 (Metro 1997). The Willamette floodplain has been dammed, diked, drained, filled, and confined to the point that it no longer functions as a healthy ecosystem with the capacity to support native fish and wildlife, absorb and reduce the impact of flooding, and filter contaminants (Allen et. al, 1999). Tributary water quality problems contribute to poor water quality when sediment and contaminants from the tributaries settle in mainstem reaches and the estuary.

Over 2,500 streams and river segments and lakes do not meet Federally-approved, state and Tribal water quality standards and are now listed as water-quality-limited under Section 303(d) of the Clean Water Act (CWA). Most of the water bodies in Oregon and Washington on the 303(d) list do not meet water quality standards for temperature. High water temperatures adversely affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that cause high stream temperatures are the removal of trees or shrubs that directly shade streams, water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals contribute to lower base-stream flows, which in turn contribute to temperature increases. Activities that create shallower streams (e.g., channel widening) also cause temperature increases.

Pollutants also degrade water quality. Many waterways in the Willamette River Basin fail to meet the CWA and Safe Drinking Water Act (SDWA) water quality standards due to the presence of pesticides, heavy metals, dioxins and other pollutants (Willamette River Basin Task Force 1997). These pollutants originate from both point sources (industrial and municipal waste) and nonpoint sources (agriculture, forestry, urban activities, etc.). The types and amounts of compounds found in runoff are often correlated with land use patterns (e.g. fertilizers and pesticides are found frequently in agricultural and urban settings, and nutrients are found in areas with human and animal waste). People contribute to chemical pollution in the basin, but natural and seasonal factors also influence pollution levels in various ways. Nutrient and pesticide concentrations vary considerably from season to season, as well as among regions with different geographic and hydrological conditions. Natural features (such as geology and soils) and land-management practices (such as storm water drains, tile drainage and irrigation) can influence the movement of chemicals over both land and water (Allen et al. 1999). Salmon require clean gravel for successful spawning, egg incubation, and the emergence of fry. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon and steelhead.

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Millions of acres of land in the basins are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion of it. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban consumption, and other uses increases temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers. Deficiencies in water quantity have impacted the McKenzie, mainstem Willamette, and Lower Columbia Rivers, all of which have experienced major agricultural development over the last century. Water withdrawals (primarily for irrigation) have lowered summer flows in nearly every stream in the basin and profoundly decreased the amount and quality of rearing habitat (Allen et al.

1999). In fact, in 1993, fish and wildlife agency, Tribal, and conservation group experts estimated that 80 percent of 153 Oregon tributaries had low-flow problems with two-thirds caused, at least in part, by irrigation withdrawals (OWRD 1993). The Northwest Power Planning Council (NWPPC) showed similar problems in many Oregon and Washington tributaries (NWPPC 1992).

Blockages that stop downstream and upstream fish movement exist at many dams and barriers, whether they are for agricultural, hydropower, municipal/industrial, or flood control purposes. Culverts that are not designed for fish passage also block upstream migration. Migrating fish are sometimes killed by being diverted into unscreened or inadequately screened water conveyances or turbines. While many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout the Columbia and Willamette basins.

On the landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density which, in turn, affect runoff timing and duration. Many riparian areas, flood plains, and wetlands that once stored water during periods of high runoff have been destroyed by development that paves over or compacts soil—thus increasing runoff and altering their natural hydrograph pattern.

Land ownership has also played it's part in the region's habitat and land-use changes. Federal lands, which compose 50 percent of the basin, are generally forested and are situated in the upstream portions of the watersheds. While there is substantial habitat degradation across all land ownership types, in general, habitat quality in many headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt et al. 1993, Frissell 1993, Henjum et al. 1994, Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992, Spence et al. 1996, Independent Science Group (ISG) 1996). Today agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

At the same time some designated critical habitat was being destroyed by water withdrawals in the Columbia basin and Willamette sub-basin, water *impoundments* in other areas dramatically reduced threatened ESU habitat by inundating large amounts of spawning and rearing habitat and reducing migration corridors, for the most part, to a single channel. Flood plains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced. Most of the remaining habitats are affected by flow fluctuations associated with reservoir management.

The Columbia River estuary, through which all the basin's anadromous species must pass, has also been changed by human activities. Historically, the downstream half of the estuary was a dynamic environment with multiple channels, extensive wetlands, sandbars, and shallow areas. The mouth of the Columbia River was about four miles wide, today it is two. Winter and spring floods, low flows in late summer, large woody debris floating downstream, and a shallow bar at the mouth of the Columbia River kept the environment dynamic. Today navigation channels have been dredged, deepened, and maintained. Jetties and pile-dike fields have been constructed to stabilize and concentrate flow in navigation channels. Marsh and riparian habitats have been filled and diked, and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia

River to two miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet.

More than 50 percent of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreational, agricultural, or urban uses. More than 3,000 acres of intertidal marsh and spruce swamps have been converted to other uses since 1948 (Lower Columbia River Estuary Program [LCREP] 1999). Many wetlands along the shore in the upper reaches of the estuary have been converted to industrial and agricultural lands after levees and dikes were constructed. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced, and the amount of water discharged during winter has increased.

Human-caused habitat alterations have also increased the number of predators feeding on listed fish. A population of terns on Rice Island (16,000 birds in 1997) consumed an estimated 6 to 25 million outmigrating salmonid smolts during 1997 (Roby et al.1998) and 7 to 15 million outmigrating smolts during 1998 (Collis et al. 1999). Rice Island is a dredged material disposal site in the Columbia River estuary, created by the USACE under its Columbia River Channel Operation and Maintenance Program. As another example, populations of Northern pikeminnow (*Ptychocheilus oregonensis*—a voracious salmonid predator) in the Columbia River have proliferated in the warm, slow-moving reservoirs created by mainstem dams. Some researchers have estimated the pikeminnow population in the John Day pool alone to be over one million (Bevan et al. 1994) and they all consume salmonids if given the opportunity. To counteract all the ill effects listed in this section, Federal, state, tribal, and private entities have, singly and in partnership, begun recovery efforts to help slow and, eventually, reverse the decline of salmon and steelhead populations. Notable efforts within the range of the ESUs under this biological opinion are the Basinwide Recovery Strategy (Federal Caucus 2000), the Northwest Forest Plan (NFP), PACFISH, the Washington Wild Stock Restoration Initiative, the Oregon Plan for Salmon and Watersheds (OPSW), and the Washington Wild Salmonid Policy. Nevertheless, much remains to be done to recover salmonids in the Columbia River basin. Full discussions of these efforts can be found in the referenced documents and in the FCRPS biological opinion.

Hatcheries

For more than 100 years, hatcheries in the Pacific Northwest have been used to (a) produce fish for harvest and (b) replace natural production lost to dam construction and other development—not to protect and rebuild naturally-produced salmonid populations. As a result, most salmonid populations in the region are primarily derived from hatchery fish. In 1987, for example, 95 percent of the coho salmon, 70 percent of the spring chinook salmon, 80 percent of the summer chinook salmon, 50 percent of the fall chinook salmon, and 70 percent of the steelhead returning to the Columbia River Basin, including the Willamette sub-basin, originated in hatcheries (CBFWA 1990). Hatchery percentage estimates, proportions of hatchery fish relative to total run size, by sub-basin are: UWR chinook 90% in the basin, UWR steelhead are 24% in the Molalla, 17% in the North Santiam, 5% to 12% in the South Santiam, and less than 5% in the Calapooia (Chilcote 1997, 1998), LCR steelhead are 92% in the Cowlitz River, and 77% in the Kalama River, 50% in the North Fork Washougal River, 0% in the mainstem Washougal River, and 0% to 1% in the North Fork Toutle and Wind rivers (NMFS 2000a). Because hatcheries have traditionally focused on providing fish for harvest and replacing declines in native runs (and generally not carefully examined their own effects on local populations), it is only recently that the substantial effects of hatcheries on native naturally produced populations been demonstrated. For example, the production of hatchery fish, among other factors, has contributed to the 90 percent reduction in naturally produced coho salmon runs in the Lower Columbia River over the past 30 years (Flagg et al. 1995).

Hatchery fish can harm native, naturally produced-run salmon and steelhead in four primary ways: (1) ecological effects, (2) genetic effects, (3) overharvest effects, and (4) masking effects (NMFS 2000a). Ecologically, hatchery fish can predate on, displace, and compete with naturally produced fish. These effects are most likely to occur when fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release disease-carrying effluent into streams. Hatchery fish can affect the genetic composition of native fish by interbreeding with them. Interbreeding can also result from the introduction of native stocks from other areas. Theoretically, interbred fish are less adapted to the local habitats where the original native stock evolved and are therefore less productive there.

In many areas, hatchery fish provide increased fishing opportunities. However, when naturally produced fish mix with hatchery stock in these areas, smaller or weaker naturally produced stocks can be over harvested Moreover, when migrating adult hatchery and naturally produced fish mix on the spawning grounds, the health of the naturally produced runs and the habitat's ability to support them can be overestimated because the hatchery fish mask the surveyors' ability to discern actual naturally produced run conditions.

Currently, the role hatcheries are to play in the Columbia Basin, including the Willamette sub-basin, is being redefined under the Basinwide Salmon Recovery Strategy (Federal Caucus 2000) from simple "production" or "supplementation" to conservation hatcheries, supporting species recovery. The Strategy contains two primary hatchery initiatives. The first is to reform all existing production and mitigation hatcheries to eliminate or minimize the harm they do to naturally produced fish. The second is to implement "safety net" projects using various artificial production techniques such as supplementation and captive broodstock programs on an interim basis to avoid extinction while other recovery actions take effect. The artificial propagation efforts will focus on maintaining species diversity and supporting weak stocks. The Strategy will also have an associated research element designed to clarify interactions between natural and hatchery fish and quantify the effects of supplementation on natural fish. The final facet of the strategy is to use hatcheries to create fishing opportunities that are benign to listed populations (e.g., terminal area fisheries). For more detail on the use of hatcheries in recovery strategies, please see the Basinwide Salmon Recovery Strategy.

Harvest

Salmon and steelhead have been harvested in the Columbia basin and Willamette sub-basin as long as there have been people there. Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. The development of non-Indian fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fisheries used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and trolling (using hook and line) fisheries developed. Recreational (sport fishing) harvest began in the late 1800s, occurring primarily in tributary locations (ODFW and WDFW 1998).

Initially, the non-Native American fisheries targeted spring and summer chinook salmon, and these runs dominated the commercial harvest during the 1800s. Eventually the combined ocean and freshwater harvest rates for Columbia River spring and summer chinook salmon, including the LCR ESU, exceeded 80 percent and sometimes 90 percent of the run—accelerating the species' decline (Ricker 1959). From 1938 to 1955, the average harvest rate dropped to about 60 percent of the total spring chinook salmon run and appeared to have a minimal effect on subsequent returns (NMFS 1991). Conservation concerns for naturally produced runs of salmon and steelhead have resulted in current harvest regulations in Washington and Oregon that limit the numbers of fish anglers can capture per day and per year. In addition these fisheries specifically target hatchery fish.

Until the spring of 2000—when a relatively large run of hatchery spring chinook salmon returned, no commercial harvest for spring chinook salmon had taken place since 1977. Present Columbia and Willamette River harvest rates are very low compared with those from the late 1930s through the 1960s (NMFS 1991). Though steelhead and chum salmon were never as important a component of the Columbia basin's fisheries as chinook salmon, net-based fisheries generally do not discriminate among species, so it can fairly be said that harvest has also contributed to the decline of all salmonid ESUs addressed in this consultation.

Salmonids' capacity to produce more adults than are needed for spawning offers the potential for sustainable harvest of naturally-produced (versus hatchery-produced) fish. This potential can be realized only if two basic management requirements are met: (1) enough adults return to spawn and perpetuate the run, and (2) the productive capacity of the habitat is maintained. Catches may fluctuate in response to such variables as ocean productivity cycles, periods of drought, and natural disturbance events, but as long as the two management requirements are met, fishing may be sustained indefinitely. Unfortunately, both prerequisites for sustainable harvest have been violated routinely in the past. The lack of coordinated management across jurisdictions, combined with competitive economic pressures to increase catches or to sustain them in periods of lower production, resulted in harvests that were too high and escapements that were too low. At the same time, habitat has been increasingly degraded, reducing the capacity of the salmon stocks to produce numbers in excess of their spawning escapement requirements.

For years, the response to declining catches was hatchery construction to produce more fish. Because hatcheries require fewer adults to sustain their production, harvest rates in the fisheries were allowed to remain high, or even increase, further exacerbating the effects of overfishing on the naturally-produced (non-hatchery) runs mixed in the same fisheries. More recently, harvest managers have instituted reforms including weak stock, abundance-based, harvest rate, and escapement-goal management. As with improvements being made in other phases of the life histories, it will take some time for these (and future) measures to contribute greatly to the species recovery, but the effort has begun.

Ocean harvest also effect listed salmonids. For example, at one point it was estimated that unauthorized high seas drift net fisheries harvested between two percent and 38 percent of the steelhead destined to return to the Pacific Coast of North America (Cooper and Johnson 1992). However, since drift nets were outlawed in 1987, and enforcement has increased, that percentage has probably decreased. Other ocean fisheries, such as West Coast Ground Fisheries regulated under the Magneson-Stevens Act, are required to minimize their salmon by-catch.

Natural Conditions

Natural Changes in the freshwater and marine environments play a major role in salmonid abundance. Recent evidence suggests that marine survival among salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Francis and Hare (1997). This phenomenon has been referred to as the Pacific Decadal Oscillation. In addition, large-scale climatic regime shifts, such as El Niño, appear to change ocean productivity. During the first part of the 1990s, much of the Pacific Coast was subject to a series of very dry years. More recently, severe flooding has adversely affected some stocks (e.g., the low returns of Lewis River bright fall chinook salmon in 1999).

A key factor affecting many West Coast stocks has been a general 30-year decline in ocean productivity. The mechanism whereby stocks are affected is not well understood, partially because the pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven largely by events occurring between ocean entry and recruitment to a subadult life stage. One indicator of early ocean survival can be computed as a ratio of coded-wire tag (CWT) recoveries from subadults relative to the number of CWTs released from that brood year. Time-series of survival rate information for Upper Willamette River spring chinook salmon, Lewis River fall chinook salmon, and Skagit fall chinook salmon show highly variable or declining trends in early ocean survival, with very low survival rates in recent years (NMFS 1999).

Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to significant natural mortality, although it is not know to what degree. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the rebound of seal and sea lion populations—following their protection under the Marine Mammal Protection Act of 1972—has caused a substantial number of salmonid deaths. In recent years, for example, sea lions have learned to target Upper Willamette River spring chinook salmon in the fish ladder at Willamette Falls.

Finally, it should be noted that the unusual drought conditions in 2001 warrant additional consideration. The available water in the Upper Columbia River Basin was 50-60% of normal and will result in some of the lowest flow conditions on record. These conditions will have the greatest effect on upriver stocks, but most salmon and steelhead will surely feel their effects. The juveniles that must pass down river during the 2001 spring and summer out-migration will likely be affected and this, in turn, will affect adult returns primarily in 2003 and 2004, depending on the stock and species. At this time, it is impossible to ascertain what those effects will be, but NMFS is monitoring the situation and will take the drought condition into account in management decisions, including amending take authorizations and other permit conditions as needed.

Scientific Research

ESA-listed and other fish in the Lower Columbia River basin and Willamette River sub-basin, are the subject of scientific research and monitoring activities. Most biological opinions NMFS issues recommend specific monitoring, evaluation, and research projects to gather information to aid the survival of listed fish. In addition, NMFS has issued numerous research permits authorizing takes of ESA-listed fish over the last few years. Each authorization for take by itself would not lead to decline of the species. However the sum of the authorized takes indicate a high level of research effort in the action area, and as anadromous fish stocks have continued to decline, the proportion of fish handled for research/monitoring purposes has increased. The effect of these activities is difficult to assess because despite the fact that fish are harassed and even killed in the course of scientific research, these activities have a great potential to benefit ESA-listed salmon and steelhead. For example, aside from simply increasing what is known about the listed species and their biological requirements, research is essentially the only way to answer key questions associated with difficult resource issues that crop up in every management arena and involve every salmonid life history stage (particularly the resource issues discussed in the previous sections). Perhaps most importantly, the information gained during research and monitoring activities can help resource managers recover listed species. That is, no rational resource allocation or management decisions can be made without the knowledge to back them up. Further, there is no way to tell if the corrective measures described in the previous sections are working unless they are monitored and no way to design new and better ones if research is not done.

In any case, scientific research and monitoring efforts (unlike the other factors described in the previous sections) are not considered to be a factor contributing to the decline of listed salmonids, and NMFS believes that the information derived from the research activities is essential to their survival and recovery. Nonetheless, fish *are* harmed during research activities. And activities that are carried out in a careless or undirected fashion are not likely to benefit the species at all. Therefore, to reduce adverse effects from research activities on the species, NMFS imposes conditions in its permits so that Permit Holders conduct their activities in such a way as to minimize adverse effects on the ESA-listed species, including keeping mortalities as low as possible. Also, researchers are encouraged to use non-listed fish species and hatchery fish instead of listed naturally-produced fish when possible. In addition, researchers are required to share fish samples, as well as the results of the scientific research, with other researchers and co-managers in the region as a way to avoid duplicative research efforts and to acquire as much information as possible from the ESA-listed fish sampled. NMFS also works with other agencies to coordinate research and thereby prevent duplication of effort.

In general, for projects that require a section 10(a)(1)(A) permit, applicants provide NMFS with high take estimates to compensate for potential inseason changes in research protocols, accidental catastrophic events, and the annual variability in listed fish numbers. Also, most research projects depend on annual funding and the availability of other resources. So, a specific research project for which take of ESA-listed species is authorized by a permit may be suspended in a year when funding or resources are not available. As a result, the *overall* take in a given year for all research projects, as provided to NMFS in post-season annual reports, is usually less than the authorized level of take in the permits and the related NMFS biological opinion on the issuance of those permits. Therefore, because actual take levels tend to be lower than authorized takes, the severity of effects to the ESA-listed species due to the conduct of scientific research activities are usually less than the effects analyzed in a typical biological opinion.

In conclusion, the picture of whether biological requirements are being met is more clear-cut for habitat-related parameters than it is for population factors: given all the factors for decline—even taking into account the conservation measures being implemented—it is still clear that the biological requirements for UWR chinook salmon, LCR chinook salmon, UWR steelhead, LCR steelhead, and CR chum salmon are currently not being met under the environmental baseline. Their status is such that there must be a significant improvement in the environmental conditions of the species' respective habitats (over those currently available under the environmental baselines). Any further degradation of the environmental conditions would have a significant impact due to the amount of risk the species presently face under the environmental baselines. In addition, there must be improvements to minimize impacts due to dams, incidental harvest, hatchery practices, and unfavorable estuarine and marine conditions.

EFFECTS OF THE ACTION

The purpose of this section is to identify the effects NMFS' issuance of scientific research permits will have on threatened UWR chinook salmon, LCR chinook salmon, UWR steelhead, LCR steelhead, and CR chum salmon. To the extent possible, this will include analyses of effects at the population level. Where information on these listed salmonids is lacking at the population level, this analysis assumes that the status of each affected population is the same as the ESU as a whole. The method NMFS uses for evaluating effects is discussed first, followed by discussions of the general effects that scientific research activities are known to have (including the effects arising from mitigation efforts) and permit-specific effects.

Evaluating the Effects of the Action

Over the course of a decade and hundreds of ESA section 7 consultations, NMFS developed the following four-step approach for using the ESA Section 7(a)(2) standards to determine what effect a proposed action is likely to have on a given listed species. What follows here is a summary of that approach; for more detail please see *The Habitat Approach*. . . (NMFS 1999).

1. Define the biological requirements and current status of each listed species;

2. Evaluate the relevance of the environmental baseline to the species' current status;

3. Determine the effects of the proposed or continuing action on listed species and their critical habitat; and,

4. Determine whether the species can be expected to survive with an adequate potential for recovery under (a) the effects of the proposed (or continuing) action, (b) the effects of the environmental baseline, and (c) any cumulative effects—including all measures being taken to improve salmonid survival and recovery.

The fourth step above requires a two-part analysis. The first part focuses on the action area and defines the proposed action's effects in terms of the species' biological requirements in that area (i.e., impacts on essential habitat features). The second part focuses on the species itself. It describes the action's impact on individual fish—or populations, or both—and places that impact in the context of the ESU as a whole. Ultimately, the analysis seeks to answer the questions of whether the proposed action is likely to jeopardize a listed species' continued existence or destroy or adversely modify its critical habitat.

Effects on Critical Habitat

Previous sections have detailed the circumstances surrounding the designation of ESUs under consultation critical habitat, described the essential features of that habitat, and depicted its present condition. The discussion here focuses on how those features are likely to be affected by the proposed actions.

Full descriptions of the proposed activities are found in the next section. In general, the activities will be (a) electrofishing—using both backpack- and boat-based equipment, (b) streamside and snorkel surveys in spawning and rearing habitat, (c) smolt trapping at dams, and (d) capturing fish with angling equipment, traps, and nets of various types. All of these techniques are minimally intrusive in terms of their effect on habitat. None of them will measurably affect any of the 10 essential fish habitat features listed earlier (i.e., stream substrates, water quality, water quantity, food, streamside vegetation, etc.). Moreover, the proposed activities are all of short duration. Therefore, NMFS concludes that the proposed activities are unlikely to adversely modify critical habitat.

Effects on UWR Chinook Salmon, LCR Chinook Salmon, UWR Steelhead, LCR Steelhead, CR Chum Salmon

The primary effects the proposed activities will have on UWR chinook salmon, LCR chinook salmon, UWR steelhead, LCR steelhead, and CR chum salmon will occur in the form of direct "take" (the ESA take definition is given on page 7), usually in the form of harassment. Harassment generally leads to stress and other sub-lethal effects and is caused by observing, capturing, and handling fish. The ESA does not define harassment nor has NMFS defined this term through regulation pursuant to the ESA. However, the USFWS defines "harassment as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering" [50 CFR 17.4]. For the purposes of this analysis, NMFS adopts this definition of harassment.

The various proposed activities, described under permit specific effects, would cause many types of take, and while there is some blurring of the lines between what constitutes an activity (e.g., electrofishing) and what constitutes a take category (e.g., harm), it is important to keep the two concepts separate. The reason for is this is that the effects being measured here are those which the activity itself has on the listed species. They may be expressed in *terms* of the take categories (e.g, how many listed salmonids are harmed, or harassed, or even killed), but the actual mechanisms of the effects themselves (i.e., the activities) are the causes of whatever take arises and, as such, they bear examination. Therefore, the first part of this section is devoted to a discussion of the general effects known to be caused by the proposed activities, regardless of where they occur or what species are involved.

The following subsections describe the types of activities being proposed. Because they would all be carried out by trained professionals using established protocols and have widely recognized specific impacts, each activity is described in terms broad enough to apply to every proposed permit. This is especially true in light of the fact that the researchers would not receive a permit unless their activities (e.g., electrofishing) incorporate NMFS' uniform, pre-established set of mitigation measures. These measures are described on page 6 of this Opinion. They are incorporated (where relevant) into every permit as part of the terms and conditions to which a researcher must adhere.

Observation

For some studies, ESA-listed fish will be observed in-water (i.e., snorkel surveys). Direct observation is the least disruptive and simplest method for determining presence/absence of the species and estimating their relative abundance. Its effects are also generally the shortest-lived among any of the research activities discussed in this section. Typically, a cautious observer can effectively obtain data without disrupting the normal behavior of a fish. Fry and juveniles frightened by the turbulence and sound created by observers are likely to seek temporary refuge behind rocks, vegetation, and deep water areas. In extreme cases, some individuals may temporarily leave the particular pool or habitat type when observers are in their area. Researchers minimize the amount of disturbance by moving through streams slowly—thus allowing ample time for fish to reach escape cover. Though it should be noted that the research may at times involve observing adult fish—which are more sensitive to disturbance. During some of the research activities discussed below, redds may be visually inspected, but no redds will be walked on. Harassment is the primary form of take associated with these observation activities, and few if any injuries or deaths are expected to occur—particularly in cases where the observation is to be conducted solely by researchers on the stream banks rather than in the water. There is little a researcher can do to mitigate the effects associated with observation activities because those effects are so minimal. In general, all they can do is move with care and attempt to avoid disturbing sediments, gravels, and, to the extent possible, the fish themselves.

Capture/handling

Capturing and handling fish causes them stress—though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived. The primary contributing factors to stress and death from handling are excessive doses of anesthetic, differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18°C or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps if the traps are not emptied on a regular basis. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis.

Based on prior experience with the research techniques and protocols that would be used to conduct the proposed scientific research, no more than five percent of the juvenile salmonids encountered are likely to be killed as an indirect result of being captured and handled and, in most cases, that figure will not exceed three percent. In addition, it is not expected that more than one percent of the adults being handled will die. In any case, all researchers will employ the mitigation measures described earlier (page 10) and thereby keep adverse effects to a minimum. Finally, any fish indirectly killed by the research activities in the proposed permits may be retained as reference specimens or used for analytical research purposes.

Electrofishing

Electrofishing is a process by which an electrical current is passed through water containing fish in order to stun them—thus making them easy to capture. It can cause a suite of effects ranging form simple harassment to actually killing the fish (adults and juveniles) in an area where it is occurring. The amount of unintentional mortality attributable to electrofishing may vary widely depending on the equipment used, the settings on the equipment, and the expertise of the technician. Electrofishing can have severe effects on adult salmonids. Spinal injuries in adult salmonids from forced muscle contraction have been documented. Sharber and Carothers (1988) reported that electrofishing killed 50 percent of the adult rainbow trout in their study. The long-term effects electrofishing has on both juveniles and adult salmonids are not well understood, but long experience with electrofishing indicates that most impacts occur at the time of sampling and are of relatively short duration.

The effects electrofishing will have on the listed salmonids under this consultation, would be limited to the direct and indirect effects of exposure to an electric field, capture by netting, holding captured fish in aerated tanks, and the effects of handling associated with transferring the fish back to the river (see the next subsection for more detail on capturing and handling effects). Most of the studies on the effects of electrofishing on fish have been conducted on adult fish greater than 300 mm in length (Dalbey et al. 1996). The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injury rates are substantially lower than they are for large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers 1988) and may therefore be subject to lower injury rates (e.g., Hollender and Carline 1994, Dalbey et al. 1996, Thompson et al. 1997). For example, McMichael et al. (1998) found a 5.1% injury rate for juvenile MCR steelhead captured by electrofishing in the Yakima River subbasin. The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and Carothers 1988, McMichael 1993, Dalbey et al. 1996, Dwyer and White 1997). Continuous direct current (DC) or low-frequency (≤30 Hz) pulsed DC have been recommended for electrofishing (Fredenberg 1992, Snyder 1992, 1995, Dalbey et al. 1996) because lower spinal injury rates, particularly in salmonids, occur with these waveforms (Fredenberg 1992, Taube 1992, McMichael 1993, Sharber et al. 1994, Dalbey et al. 1996). Only a few recent studies have examined the long-term effects of electrofishing on salmonid survival and growth (Ainslie et al. 1998, Dalbey et al. 1996, Taube 1992). These studies indicate that although some of the fish suffer spinal injury, few die as a result. However, severely injured fish grow at slower rates and sometimes they show no growth at all (Dalbey et al. 1996).

NMFS' electrofishing guidelines (NMFS 2000b) will be followed in all surveys requiring this procedure. The guidelines require that field crews be trained in observing animals for signs of stress and shown how to adjust electrofishing equipment to minimize that stress. Electrofishing is used only when other survey methods are not feasible. All areas for stream and special needs surveys are visually searched for fish before electrofishing may begin. Electrofishing is not done in the vicinity of redds or spawning adults. All electrofishing equipment operators are trained by qualified personnel to be familiar with equipment handling, settings, maintenance, and safety. Operators work in pairs to increase both the number of fish that may be seen and the ability to identify individual fish without having to net them. Working in pairs also allows the researcher to net fish before they are subjected to higher electrical fields. Only DC units will be used, and the equipment will be regularly maintained to ensure proper operating condition. Voltage, pulse width, and rate will be kept at minimal levels and water conductivity will be tested at the start of every electrofishing session so those minimal levels can be determined. Due to the low settings used, shocked fish normally revive instantaneously. Fish requiring revivification will receive immediate, adequate care.

The preceding discussion focused on the effects of using a backpack unit for electrofishing and the ways those effects will be mitigated. It should be noted, however, that in larger streams and rivers electrofishing units are sometimes mounted on boats. These units often use more current than backpack electrofishing equipment because they need to cover larger (and deeper) areas and, as a result, can have a greater impact on fish. In addition, the environmental conditions in larger, more turbid streams can limit researchers' ability to minimize impacts on fish. For example, in areas of lower visibility it is difficult for researchers to detect the presence of adults and thereby take steps to avoid them. Because of its greater potential to harm fish, and because NMFS has not published appropriate guidelines, boat electrofishing has not been given a general authorization under NMFS' recent ESA section 4(d) rules. However, it is expected that guidelines for safe boat electrofishing will be in place in the near future. And in any case, all researchers intending to use boat electrofishing will use all means at their disposal to ensure that a minimum number of fish are harmed (these means will include a number of long-established protocols that will eventually be incorporated int NMFS' guidelines).

<u>Tagging/marking</u>

Techniques such as PIT-tagging (passive integrated transponder tagging), coded wire tagging, fin-clipping, and the use of radio transmitters are common to many scientific research efforts using ESA-listed species. All sampling, handling, and tagging procedures have an inherent potential to stress, injure, or even kill the marked fish. This section discusses each of the marking processes and its associated risks.

A PIT tag is an electronic device that relays signals to a radio receiver; it allows salmonids to be identified whenever they pass a location containing such a receiver (e.g., any of several dams) without researchers having to handle the fish again. The tag is inserted into the body cavity of the fish just in front of the pelvic girdle. The tagging procedure requires that the fish be captured and extensively handled, therefore any researchers engaged in such activities will follow the conditions listed on page 10 of this Opinion (as well as any permit-specific terms and conditions) to ensure that the operations take place in the safest possible manner. In general, the tagging operations will take place where there is cold water of high quality, a carefully controlled environment for administering anesthesia, sanitary conditions, quality control checking, and a carefully regulated holding environment where the fish can be allowed to recover from the operation.

PIT tags have very little effect on growth, mortality, or behavior. The few reported studies of PIT tags have shown no effect on growth or survival (Prentice et al. 1987, 1990; Jenkins and Smith 1990; Prentice 1990). For example, in a study between the tailraces of Lower Granite and McNary Dams (225 km), Hockersmith et al. (2000) concluded that the performance of yearling chinook salmon was not adversely affected by gastrically- or surgically implanted sham radio tags or PIT-tags. Additional studies have shown that growth rates among PIT-tagged Snake River juvenile fall chinook salmon in 1992 (Rondorf and Miller 1992) were similar to growth rates for salmon that were not tagged (Conner et al. 2001). Prentice and Park (1984) also found that PIT-tagging did not substantially affect survival in juvenile salmonids.

Coded wire tags (CWTs) are made of magnetized, stainless-steel wire. They bear distinctive notches that can be coded for such data as species, brood year, hatchery of origin, and so forth (Nielson 1992). The tags are intended to remain within the animal indefinitely, consequently making them ideal for making long-term, population-level assessments of Pacific Northwest salmon. The tag is injected into the nasal cartilage of a salmon and therefore causes little direct tissue damage (Bergman et al. 1968; Bordner et al. 1990). The conditions for inserting CWTs are similar to those required for applying PIT-tags.

A major advantage to using CWTs is the fact that they have a negligible effect on the biological condition or response of tagged salmon; however if the tag is placed too deeply in the snout of a fish, it may increase mortality, reduce growth, or damage olfactory tissue (Fletcher et al. 1987; Peltz and Miller 1990). This latter effect can create problems for species like salmon because they use olfactory clues to guide their spawning migrations (Morrison and Zajac 1987).

In order for researchers to be able to determine later (after the initial tagging) which fish possess CWTs, it is necessary to mark the fish externally—usually by clipping the adipose fin—when the CWT is implanted. One major disadvantage to recovering data from CWTs is that the fish must be killed in order for the tag to be removed. However, this is not a significant problem because researchers generally recover CWTs from salmon that have been taken during the course of commercial and recreational harvest (and are therefore already dead).

In order for researchers to be able to determine later (after the initial tagging) which fish possess CWTs, it is necessary to mark the fish externally—usually by clipping the adipose fin—when the CWT is implanted (see text below for information on fin clipping). One major disadvantage to recovering data from CWTs is that the fish must be killed in order for the tag to be removed. However, this is not a significant problem because researchers generally recover CWTs from salmon that have been taken during the course of commercial and recreational harvest (and are therefore already dead).

The other primary method for tagging fish is to implant them with radio tags. There are two main ways to accomplish this and they differ in both their characteristics and consequences. First, a tag can be inserted into a fish's stomach by pushing it past the esophagus with a plunger. Stomach insertion does not cause a wound and does not interfere with swimming. This technique is benign when salmon are in the portion of their spawning migrations during which they do not feed (Nielson, 1992). In addition, for short-term studies, stomach tags allow faster post-tagging recovery and interfere less with normal behavior than do tags attached in other ways.

The second method for implanting radio tags is to place them within the body cavities of (usually juvenile) salmonids. These tags do not interfere with feeding or movement. However, the tagging procedure is difficult, requiring considerable experience and care (Nielson 1992). Because the tag is placed within the body cavity, it is possible to injure a fish's internal organs. Infections of the sutured incision and the body cavity itself are also possible, especially if the tag and incision are not treated with antibiotics (Chisholm and Hubert 1985, Mellas and Haynes 1985).

Fish with internal radio tags often die at higher rates than fish tagged by other means because radio tagging is a complicated and stressful process. Mortality is both acute (occurring during or soon after tagging) and delayed (occurring long after the fish have been released into the environment). Acute mortality is caused by trauma induced during capture, tagging, and release. It can be reduced by handling fish as gently as possible. Delayed mortality occurs if the tag or the tagging procedure harms the animal in direct or subtle ways. Tags may cause wounds that do not heal properly, may make swimming more difficult, or may make tagged animals more vulnerable to predation (Howe and Hoyt 1982, Matthews and Reavis 1990, Moring 1990). Tagging may also reduce fish growth by increasing the energetic costs of swimming and maintaining balance. As with the other forms of tagging and marking, researchers will keep the harm caused by radio tagging to a minimum by following the conditions given on page 5 of this Opinion, as well as any other permit-specific requirements.

Fin clipping is the process of removing all or parts of one or more fins to alter a fish's appearance and thus make it identifiable. When entire fins are removed, it is expected that they will never grow back. Alternatively, a permanent mark can be left when only a part of the fin is removed or the ends of a fin or a few fin rays are clipped. Although researchers have used all fins for marking at one time or another, the current preference is to clip the adipose, pelvic, or pectoral fins. Marks can also be made by punching holes or notches in fins, severing individual fin rays (Welch and Mill 1981), or removing single prominent fin rays (Kohlhorst 1979). Many studies have examined the effects of fin clips on fish growth, survival, and behavior. The results of these studies are somewhat variable; however, it can be said that fin clips do not generally alter fish growth. Studies comparing the growth of clipped and unclipped fish generally have shown no differences between them (e.g., Brynildson and Brynildson 1967). Moreover, wounds caused by fin clipping usually heal quickly—especially those caused by partial clips.

Mortality among fin-clipped fish is also variable. Some immediate mortality may occur during the marking process, especially if fish have been handled extensively for other purposes (e.g., stomach sampling). Delayed mortality depends, at least in part, on fish size. Small fishes have often been found to be susceptible to it and (Coble 1967) suggested that fish shorter than 90 mm are at particular risk. The degree of mortality among individual fishes also depends on which fin is clipped. Studies show that adipose- and pelvic-fin-clipped coho salmon fingerlings have a 100% recovery rate (Stolte 1973). Recovery rates for steelhead were 60% when the adipose fin was clipped and 52% when the pelvic fin was clipped and dropped markedly when the pectoral, dorsal, and anal fins were clipped (Nicola and Cordone 1973). Clipping the adipose and pelvic fins probably kills fewer fish because these fins aren't used much for movement or balance (McNeil and Crossman 1979). Mortality is generally higher when the major median and pectoral fins are clipped. Mears and Hatch (1976) showed that clipping more than one fin may increase delayed mortality, but other studies have been less conclusive.

Regardless, any time researchers clip or remove fins, it is necessary that the fish be handled. Therefore, the same safe and sanitary conditions required for tagging operations also apply to clipping activities.

<u>Sacrifice</u>

In some instances, it is necessary to kill a captured fish in order to gather whatever data a study is designed to produce. In such cases, determining effect is a very straightforward process: the sacrificed fish, if juveniles, are forever removed from the ESU's gene pool; if the fish are adults, the effect depends upon whether they are killed before or after they have a chance to spawn. If they are killed after they spawn, there is very little overall effect. Essentially, it amounts to removing the nutrients their bodies would have provided to the spawning grounds. If they are killed before they spawn, not only are they removed from the ESU, but so are all their potential progeny. Thus, killing pre-spawning adults has the greatest potential to affect their ESU and, because of this, NMFS rarely allows it to happen. And, in almost every instance where it is allowed, the adults are stripped of sperm and eggs so their progeny can be raised in a controlled environment such as a hatchery—thereby greatly decreasing the potential harm posed by sacrificing the adults. Clearly, there is no way to mitigate the effects of outrightly sacrificing a fish.

Permit-specific Effects

The NWFSC releases a report annually that estimates outmigration numbers of juvenile Upper Willamette River and Lower Columbia River salmon and steelhead for the Columbia River Basin. The estimates are generated from redd counts in tributary spawning areas, hatchery release estimates, fish collections at dams, and other observation points. The fish are categorized by ESU and whether they are natural or hatchery. NMFS uses the estimates generated at Tongue Point because it is the location farthest downstream in the Columbia River Basin, thus, it is the most appropriate place given the ESUs addressed in this consultation.

2001 NWFSC smolt out–migration estimates to Tongue Point (NMFS 2001a)			
Total wild listed steelhead		LCR (13.33% of total)	UWR (10.81% of total)
1,726,286		230,168	186,655
Total wild listed chinook salmon		LCR (percent of total) Fall 94.02% Spring 75.67%	UWR (12.67% of total)
Total	17,411,043	15,551,406	564,219
Fall	12,957,851	12,181,676	
Spring	4,453,192	3,369,730	
Total wild chum salmon			
301,320			

2001 Adult Escapement Estimates
LCR chinook salmon 10,000 (NMFS 2000a)
UWR chinook salmon 2,523 (NMFS 2001b)
LCR steelhead 10,441 (McClure 2001)
CR chum salmon 851 (McClure 2001)

Amendment to Modification 1 of Permit 1102

The amendment to Permit 1102, modification 1, would authorize the WDFW to collect up to 38 adult LCR steelhead at Bonneville Dam and to handle an unquantifiable number of LCR chinook salmon and steelhead carcasses from the fishery in the Columbia River. No the indirect mortality is requested.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mort. Adult	Juvenile	Sacrifice Adult	Juvenile
1102	LCR steelhead	38					

Although non–lethal tissues samples will be taken from the captured LCR steelhead, the researchers will use all due care by anesthetizing fish before sampling and allowing them to recover in a holding tank before release over the dam. There is a low rate of mortality associated with these research methods; from 1994-1997 more than 8,700 steelhead were sampled in the same fashion and only two mortalities resulted. The adult trap may slow fish passage by a day at most but most steelhead take up to a week in the Bonneville Reservoir.

Amendment to Modification 1 of Permit 1134

The amendment to Permit 1134, modification 1, would authorize CRITFC to collect up to 10 adult LCR chinook at Bonneville Dam for scientific research in the Columbia River. No adult indirect mortalities are authorized.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1134	LCR chinook	10					

NMFS estimates that at least 10,000 LCR chinook salmon will return to the Columbia River this year (NMFS, 2000a). The maximum of 10 fish that will be captured, sampled, and released during the research activities will have an insignificant effect on the ESU as a whole.

Although tissues samples will be taken from the captured LCR chinook, the researchers will use all due care by anesthetizing fish before sampling and allowing them to recover in a holding tank before release. Although the adult trap may slow fish passage by a day, it is believed to be of little consequence in the context of the week–long passage through the Bonneville Reservoir.

Permit 1156 Modification 1

Permit 1156, modification 1, would authorize the EPA/Dynamac to use electrofishing to capture up to 100 juvenile UWR chinook salmon, 20 juvenile LCR chinook salmon, 50 juvenile UWR steelhead, and 25 juvenile LCR steelhead in the Willamette River in Oregon, and the Cowlitz, Lewis, and Columbia Rivers in Washington. Up to one adult and two juvenile UWR chinook salmon, one juvenile UWR steelhead, and one juvenile LCR steelhead may be killed as an indirect result of the capturing and handling process. EPA/Dynamac is also authorized an incidental take (capture and release) of 42 adult

UWR chinook salmon, six adult LCR chinook salmon, 20 adult UWR steelhead, and 10 adult LCR steelhead associated with the scientific research.

Permit #	ESU	capture/handle/release		indirect mortality		Sacrifice	
		Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
1156	UWR chinook	42	100		2		
	LCR chinook	6	20				
	UWR steelhead	20	50		1		
	LCR steelhead	10	25		1		

Should any adults be encountered (as incidental take), they will not be handled in any way—merely counted. Any juveniles encountered will be examined and released as soon as they have recovered from effects of being captured. They will not be tissue-sampled or marked, and will only be used to determine the species presence/absence (and their proportionate abundances) at the sample site.

It should be noted that the take numbers above are conservative estimates. The maximum one adult UWR chinook salmon killed due to capture and handling is minor relative to the estimated 2,523 fish returning to the Willamette to spawn. Similarly NMFS believes that the four listed juvenile fish that will be killed as a result of research activities are insignificant, minuscule with respect to the ESU as a whole.

The researchers will use ODFW and WDFW district biologist expertise to reduce encounters with listed species. To minimize electrofishing injury, the researchers will use a low pulse rate (30 pulses/s), a narrow pulse width (< 6msec), and a low peak voltage (500 V). These settings minimize harm to larger fish and, though they are not as effective for collecting small fish, they do stimulate benthic species to move up in the water column where they are more easily netted. For the raft-mounted electrofishing gear, the researchers will employ large cathodes (20 droppers) and 6 anode droppers to reduce the field strength in the vicinity of the electrodes and use lower voltages. Stunned fish will be recovered using a soft mesh dipnet and placed in a holding tank. Following the data collection, the fish will be placed back in the holding tank to recover before being released alive. If it is observed that juvenile salmonids are being harmed, the researchers will increase the pulse rate (which decreases the potential damage to small fish but increases the potential threat to larger fish). If large and small salmonids are present and the small individuals show evidence of injury, the researchers will shorten the holding time in the live well. All operators of electrofishing equipment will be fully trained.

Permit 1140 Modification 2

Permit 1140, modification 2, would authorize the NWFSC to use seines and nets to capture up to two juvenile UWR chinook salmon, 45 juvenile LCR chinook salmon, one juvenile UWR steelhead, two juvenile LCR steelhead, and 2 juvenile CR chum salmon in selected coastal estuaries in Oregon and Washington. In addition, an estimated one juvenile LCR chinook salmon will be killed as an indirect result of the capturing and handling process.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1140	UWR chinook		2				
	LCR chinook		45		1		
	UWR steelhead		1				
	LCR steelhead		2				
	CR chum		2				

Although the spatial habitat of LCR fall chinook, the focus of this study, overlaps those of non–target fish (UWR spring chinook, UWR steelhead, and LCR steelhead) the timing of their respective migrations are such that it is highly unlikely non–target fish will be present at the time of sampling. Despite the low probability that these non–target fish will be captures in NWFSC's nets, NMFS has conservatively authorized incidental take (capture/ handle/ release) for these non–target ESUs so that take estimates will not ve underestimated. Furthermore, the researchers will exercise all due care and the previously described preventative measures to ensure that any captures non–target fish are safely returned to their point of capture.

Permit 1135

Permit 1135 would authorize the USGS to use backpack electrofishing to capture up to 1,500 juvenile LCR steelhead in the Wind River Basin in Washington. Forty-eight of those fish would be sacrificed, and the permit would allow 27 more to be killed as an indirect result of the capturing and handling process. An unspecified number of adult and juvenile LCR steelhead would be observed/harassed during snorkeling and habitat surveys in the basin.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1135	LCR steelhead		1,500		27		48

There are no estimates available for 2001 juvenile LCR steelhead production in the Wind River system, however, NMFS estimates (NMFS 2001a) that 20,292 juveniles will pass Bonneville Dam. The remaining steelhead-producing tributaries of consequence in the action area are the White Salmon and Hood Rivers, production estimates are also unavailable for these tributaries. The 48 fish that would be sacrificed in the research (come out of a total of over 20,000 fish) will constitute only 0.2 percent of the portion of the ESU that migrates past the Bonneville Dam. When placed in the context of the ESU as a whole, which is expected to produce a total of 230,168 outmigrants passing Tongue Point in 2001 (NMFS 2001a), the long term impact of the authorized take would be small (<0.02% of the total outmigrant production.

The effects of the non-lethal take would be mitigated by the various means discussed earlier. The researchers would use a great deal of care to ensure that the captured fish that are not sacrificed are safely returned to the river. The estimate that 27 fish would be indirectly killed is conservative and based on many years of expertise in determining the effects of capturing and handling juvenile salmonids. There is, of course, no way to mitigate the effects resulting from purposely sacrificing 48 juveniles. It is NMFS's position, however, that those effects would be offset by the knowledge likely to be gained from the research that will be used in future species recovery.

Permit 1175

Permit 1175 would authorize the GPNF to use seines and electrofishing to capture up to 250 juvenile LCR chinook salmon and 250 juvenile LCR steelhead in the Cowlitz, Toutle, Lewis, Wind, and White Salmon Rivers on forest lands. Up to five juvenile LCR chinook salmon and five juvenile LCR steelhead maybe killed indirectly as a result of fish handling. In addition, an unspecified number of adult and juvenile fish may be observed during snorkel surveys.

Permit #	ESU	capture/handle/release		indirect mortality		Sacrifice	
		Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
1175	LCR chinook		250		5		
	LCR steelhead		250		5		

The five juvenile LCR chinook salmon that may be indirectly killed, when put into the context of 15,551,406 outmigrants to Tongue Point, insignificant to the ESU as a whole. Likewise, relative to the estimated 230,168 juvenile LCR steelhead outmigrants, the indirect mortality of five fish, only 0.002 % of the entire ESU. Researchers will use all due care (and the previously described mitigation measures) to ensure that any captured salmonids are returned to their river safely.

Permit 1252

Permit 1252 would authorize the WDOT to use passive observation techniques, dip nets, seines, minnow traps, rod and reel, and electrofishing to observe/harass and capture up to six juvenile LCR chinook salmon, five LCR steelhead, and 30 CR chum salmon while conducting presence/absence surveys in waters near proposed WDOT projects on state highways in Washington. Up to one juvenile CR chum salmon may be indirectly killed as a result of fish handling.

Permit #	ESU	capture/handle/release		indirect mortality		Sacrifice	
		Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
1252	LCR chinook		6				
	LCR steelhead		5				
	CR chum		30		1		

In all cases, the fish will be held for as short a time as possible (no more than 30 minutes and generally less than three) before they are identified, counted, and returned to the river.

The fish will be captured from widely dispersed sample sites: It is impossible to determine take for individual WDOT projects. The projects are only *planned* at this stage and it is not certain if they will actually be implemented. The activities taking place under the permit may indirectly kill one chum salmon out of more than 301,320 fish. The adverse effects of this take are negligible.

The WDOT will minimize any adverse effects from the research by: (a) adapting the survey method to the size of the system to be surveyed; (b) sampling for short periods only, with the exception of baited minnow traps, and targeting pools and riffles; (c) keeping fish in the water unless it is absolutely necessary to remove them; and (d) checking baited minnow traps daily. Though the WDOT does not plan to use electrofishing in waters inhabited by listed salmonids, if it *is* used it will not take place in waters where water temperatures are very high (> 24°C) or very low (< 4°C), and it will not be conducted when samplers cannot see the stream bottom in one foot of water. Furthermore, in all cases, NMFS' electrofishing guidelines will be followed.

Permit 1256

Permit 1256 would authorize the BLM to use backpack electrofishing, seining, dipnetting, and rotary trapping to capture up to 150 post–spawning adult and 450 juvenile UWR chinook salmon in the Upper Willamette and McKenzie Rivers for stream habitat surveys when weather and stream flows permit. In addition, up to three adult and nine juvenile UWR chinook salmon may be indirectly killed as a result of the research activities.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1256	UWR chinook	150	450	3	9		

Data will be collected year–round. A rotary trap will operate from February through the first of June. UWR chinook salmon spawning surveys take place from September to October spanning 10-15 miles of stream. Researchers will use all due care (and the previously described mitigation measures) to ensure that any captured salmonids are returned to the river safely and NMFS' electrofishing guidelines will be followed. The three adult salmon that may be killed during the course of this research would be only 0.1 % of the estimated 2,523 adult escapement returning to the Willamette River (NMFS, 2001b). Likewise, the nine juveniles that may be indirectly killed constitute only a minor portion of the estimated 564,219 outmigrants from this ESU. Such small take are not likely to have any effect on a single population or the ESU as a whole.

Permit 1290

Permit 1290 would authorize the NWFSC to use purse seines and beach seines to capture up to 72 juvenile UWR chinook salmon, 397 juvenile LCR chinook salmon, 11 juvenile UWR steelhead, 14 LCR steelhead, and 5 CR chum salmon in the Columbia River estuary. If insufficient samples are obtained in the estuary, NWFSC proposes to obtain fish from the juvenile bypass at Bonneville Dam. A lethal take of up to 20 juvenile UWR chinook salmon and 69 juvenile LCR chinook salmon would be authorized. In addition, up to one juvenile UWR chinook salmon and eight juvenile LCR chinook salmon may be indirectly killed as a result of fish handling.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1290	UWR chinook		72		1		20
	LCR chinook		397		8		69
	UWR steelhead		11				
	LCR steelhead		14				
	CR chum		5				

All Willamette and Lower Columbia River ESUs mix freely as they pass through the estuary during the late spring and early summer months. Therefore, the impacts of the research on a specific population can not be quantified. The lethal take of juvenile UWR chinook salmon would be a minor portion of the ESU as a whole (which is expected to produce over 500,000 outmigrants), while the fish incidently killed would be an even smaller fraction. The lethal take of 69 juvenile LCR chinook salmon would be similarly result in only a minor portion of the ESU as a whole (which is estimated to produce 15,551,406 outmigrants). The impact on the ESU from incidently killed LCR chinook would also be negligible.

Permit 1291

Permit 1261 would authorize the USGS to capture, handle and release up to 8,098 juvenile LCR chinook salmon and 483 juvenile LCR steelhead, plus up to 48 LCR steelhead will be implanted with radio transmitters, transported, held for as long as 24 hours, released, and tracked electronically. The research project will be conducted at John Day, The Dalles, and Bonneville Dams. In addition, up to 162 juvenile LCR chinook salmon and 11 juvenile LCR steelhead may be indirectly killed as a result of fish handling.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1291	LCR chinook		8,098		162		
	LCR steelhead		531		11		

All listed fish will be captured in the smolt bypass facilities of either John Day or Bonneville Dam. The fish captured for the tagging study will be tagged with radio transmitters and transported up- or downstream and released; the rest will be allowed to recover from the MS-222 anesthetic (used when sorting captured juvenile salmonids by species) and returned immediately to the river. The mortality level for both studies is estimated to be two percent. This is a conservative estimate based on (a) past experience capturing, handling, and tagging fish at these facilities; (b) the fact that a number of studies (e.g., Hockersmith et al. 2000) have concluded that the performance of yearling chinook salmon is not adversely affected by gastrically- or surgically implanted sham radio tags; and (c) previous USGS studies showing that more than 99% of fish that have been implanted with radio tags survive for (at least) 21 days of observation (USGS 2001).

In any case, the numbers of LCR chinook salmon juveniles that may be killed in the Fish Collection Request and LCR steelhead juveniles that may—at an absolute maximum—be killed in the Fish Collection Request and the Handle, Tag, and Release Request constitute a small enough fraction of their respective runs, that the effects are difficult to measure at all. Because the fish will be taken from a random sample of LCR chinook and steelhead arriving at John Day and (possibly) Bonneville Dams, there is no way to determine their populations of origin.

Nonetheless, even though the percentage of the run that is likely to be killed by this research is extremely small, the USGS will implement the following measures to minimize impacts on LCR chinook and steelhead being handled and tagged: (1) Fish with PIT tags will not be tagged with radiotransmitters. (2) As fish are moved through the tanks at the dams, they will be examined thoroughly to ensure that they are not being harmed by tank hardware. (3) The fish will be anesthetized and sorted as quickly as possible in small batches to ensure that they are not exposed to anesthesia for unnecessarily long periods of time. (4) The transmitters will be implanted as quickly and safely as possible—while always taking the condition of the fish into account. (5) The USGS will use an artificial slime restorer and a buffer when fish are anesthetized. (6) They will administer antibiotics intraperitoneally and disinfect all surgical instruments to protect the fish from infection. (7) They will adapt the implantation technique to the size and condition of the fish to minimize the stress associated with tagging. (8) The fish will only be netted when necessary and only with sanctuary nets. (9) Oxygen and high-flow water will be provided to help fish recover from the tagging procedures. (10) The holding tanks will be supplied with de-gassing columns to keep nitrogen saturation levels down.

Moreover, because some "minimal" portion of the tagged fish are to be transported—by truck or boat or both—the USGS will also take the following precautions during that portion of the operation: (1) The fish will be held in 125-liter containers at low densities (four to five fish per container); (2) transit times will only be 20-30 minutes long (though bad weather may slow boat transport to the release spot); and (3) the temperature in the containers will be maintained within one degree of ambient river temperature by the addition of either chlorine-free ice or fresh river water.

NMFS believes all these measures—together with the standard mitigation measures mentioned earlier—will adequately minimize any adverse impacts arising from the capturing, handling, tagging, and transportation processes. This, coupled with the extremely small percentage of fish expected to be killed in even a worst-case scenario, indicates that the research will have no more than a negligible adverse effect on the ESUs.

Permit 1293

Permit 1293 would authorize the NRC to use electrofishing and angling to capture up to 15 juvenile LCR chinook salmon, 10 juvenile LCR steelhead, and 13 juvenile CR chum salmon in numerous headwater streams throughout Oregon and Washington. No listed fish will be killed due to research activities.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1293	LCR chinook		15				
	LCR steelhead		10				
	CR chum		13				

The presence–absence sampling will occur over a wide area, such that it will not be possible to determine the population of origin for handled fish. The numbers of fish to be captured handled and released are negligible when compared, with the total number of juveniles out–migrating for each ESU sampled (NMFS, 2001a), thus NMFS anticipates no adverse effects from the proposed research.

Any effects of the take would be mitigated by the various means discussed earlier. The researchers would use a great deal of care to ensure that the captured fish are returned to the river safely.

Permit 1312

Permit 1312 would authorize the ORM to use electrofishing to capture one juvenile LCR chinook salmon, one juvenile LCR steelhead, and one juvenile CR chum salmon in multiple river basins in western Washington State. No mortality is expected to occur during the electrofishing efforts since few listed fish are expected to be encountered.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1312	LCR chinook		1				
	LCR steelhead		1				
	CR chum		1				

NMFS electrofishing guidelines will be observed. The researchers would use a great care to ensure that the captured fish are returned to the river safely. Researchers do not expect to encounter any listed fish, however, the amount of take allowed would have no effect on specific populations or the entire ESUs.

Permit 1318

Permit 1318 would authorize the ODFW to use boat electrofishing, beach seines and mid-water trawls and gill nets to capture up to 359 juvenile UWR chinook salmon, 39 juvenile LCR chinook salmon, 32 juvenile UWR steelhead, and 22 juvenile LCR steelhead. The take would occur during four state wide research projects which may sample the above-listed fish. Up to 34 juvenile UWR chinook salmon, four juvenile LCR chinook salmon, three juvenile UWR steelhead, and two juvenile LCR steelhead, may be indirectly killed as a result of capture and handling.

Permit #	ESU	capture/handle/release		indirect mortality		Sacrifice	
		Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
1318	UWR chinook		359		7		
	LCR chinook		39		1		
	UWR steelhead		32		1		
	LCR steelhead		22				

Juvenile salmonids will be captured using soft mesh dip nets, identified to species, allowed to recover in a live well on the electrofishing boat, and released. No adults will be captured. In addition, researchers will closely monitor all captured fish to determine the ideal equipment settings to avoid injuring salmonids. The juvenile outmigration estimate for UWR chinook is 564,219. The seven fish which may be indirectly killed constitute only 0.001 %, and therefore the research will have a negligible effect on the ESU as a whole. Similarly, the loss of one LCR chinook salmon and one UWR steelhead is not expected to impact their respective ESUs.

<u>Permit 1322</u>

Permit 1322 would authorize the NWFSC to use beach seining and trapnetting to capture up to two juvenile UWR chinook salmon, 1,056 juvenile LCR chinook salmon, two juvenile UWR steelhead, two juvenile LCR steelhead, and two juvenile CR chum salmon in the Lower Columbia River estuary. The research will be authorized to sacrifice seven UWR chinook salmon and 266 juvenile LCR chinook salmon. Up to one juvenile UWR chinook salmon and 12 LCR chinook salmon maybe killed indirectly as a result of sampling activities.

Permit #	ESU	capture/handle/release		indirect mortality		Sacrifice	
		Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
1322	UWR chinook		2		1		7
	LCR chinook		1,056		12		266
	UWR steelhead		2				
	LCR steelhead		2				
	CR chum		2				

The NWFSC proposes to place beach seines at eight sampling sites near the Astoria Bridge and trapnets at four sites in Cathlamet Bay. Monthly, up to ten juvenile fish from each species at each of the twelve sampling sites will be sacrificed for stomach content, scale, and otolith analyses. Any indirect lethal takes will be used in place of the sacrificed fish.

It is not possible to determine the exact origin within the ESU for the sample fish. As the study targets fall chinook, it is unlikely that *any* UWR spring chinook salmon, UWR steelhead, or LCR steelhead will be encountered. It should be noted that take estimates are conservative overestimates included for safety and completeness' sake.

The number of fish authorized to be killed, indirectly or sacrificed, represent only 0.001 % of the total 564,219 juvenile outmigrants estimated for the UWR chinook salmon ESU and less than 0.002 % of the total 15,551,406 juvenile outmigrants estimated for the LCR chinook salmon population, These percentages are very small and are not expected to adversely effect the ESUs. The effects of the non-lethal take would be mitigated by the various means discussed earlier. The researchers would use a great care to ensure that the captured fish that are not sacrificed are safely returned to the estuary. There is, of course, no way to mitigate the effects resulting from purposely sacrificing 266 juveniles. It is NMFS position that the effects of sacrificing 266 juveniles will be offset by the knowledge gained from the research and its application toward the recovery of the species.

Permit 1326

Permit 1326 would authorize the CGI to use boat electrofishing and intake–porthole nets to capture up to one adult and 13 juvenile UWR chinook salmon, one adult and 23 juvenile LCR chinook salmon, one adult and 13 juvenile UWR steelhead, and one adult and 13 juvenile LCR steelhead, at dry dock number four, in Portland Harbor, on the Lower Willamette River. An air curtain screen will also be used to deter salmonids from entering the portholes in dry dock number four. No listed fish will be killed as a result of these research activities, nor will researchers attempt to capture adult fish.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1326	UWR chinook	1	13				
	LCR chinook	1	23				
	UWR steelhead	1	13				
	LCR steelhead	1	13				

However, juvenile salmonids will be captured, (using dipnets or porthole nets), as well as, identified, anesthetized, measured, weighed, and released. Researchers will use all due care, follow the previously described mitigation measures, and adhere to NMFS' electrofishing guidelines to ensure that any captured salmonids are returned safely to the river.

Permit 1327

Permit 1327 would authorize the WWU to use boat electrofishing to capture up to 17 juvenile UWR chinook salmon, and three adult UWR steelhead in the Willamette and McKenzie Rivers. No listed fish will be killed as a result of sampling.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1327	UWR chinook		17				
	UWR steelhead	3					

Even though the adverse effects associated with the research are very small, researchers will work to minimize them even further. In the event that a listed salmonid is seen in the electrofishing area, sampling will be stopped and the boat will move to another sample site. Additionally, fish will be allowed to recover in a holding tank before being released to the river.

Given the number of juvenile UWR chinook outmigrants estimated (NMFS 2001a) the research allowed under Permit 1327 is not likely to adversely effect the ESU. Likewise, the research is not expected to negatively impact the UWR steelhead ESU.

Permit 1328

Permit 1328 would authorize the LGW to use boat electrofishing to capture up to three adult and 84 juvenile UWR chinook salmon, 534 juvenile LCR chinook salmon, three adult and 60 juvenile UWR steelhead, and three adult and 12 juvenile LCR steelhead in Portland Harbor on the Lower Willamette River. Up to two juvenile UWR chinook salmon, 11 juvenile LCR chinook salmon, and one juvenile UWR steelhead may be indirectly killed as a result of the research activities.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1328	UWR chinook	3	84		2		
	LCR chinook		534		11		
	UWR steelhead	3	60		1		
	LCR steelhead	3	12				

Though the adverse effects associated with the research are very small researchers will work to minimize them even further. Researchers will immediately place fish into a holding tank with anesthetic where the naturally–produced fish will be sorted from hatchery fish and allowed to recover in a separate live-well before being released into the river. If an adult salmonid is encountered, there will be no attempt made to net it and electrofishing will cease in that area.

NMFS does not believe that the loss of two juvenile UWR chinook salmon, 11 juvenile LCR fall chinook salmon, and one UWR steelhead, will result in a substantial impact to any of the ESUs as a whole.

Permit 1330

Permit 1330 would authorize Weyerhaeuser to use boat electrofishing to capture up to 260 juvenile LCR steelhead in Harrington Creek in the Toutle River Basin. Up to two juvenile LCR steelhead may be killed indirectly as a result of sampling.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1330	LCR steelhead		260		2		

All captured fish will be anesthetized before handling and allowed to recover before being released. There will be no attempt to capture adult listed fish. The effect of the requested take on the ESU as a whole is negligible.

Permit 1333

Permit 1333 would authorize OSU to use boat electrofishing to capture up to five adult and nine juvenile UWR chinook salmon, one adult and 12 juvenile LCR chinook salmon, three adult and four juvenile UWR steelhead, one adult and one juvenile LCR steelhead in the Willamette River from the McKenzie River to the Columbia River. No listed fish will be killed during the research activities.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1333	UWR chinook	5	9				
	LCR chinook	1	12				
	UWR steelhead	3	4				
	LCR steelhead	1	1				

Though the adverse effects associated with the research are very small, researchers will work to minimize them even further by making no attempt made to net adult salmonids. If an adult is encountered, electrofishing will cease in that area. All dead specimens will be preserved and cataloged in the Oregon State University Fish Collection. Given the number of outmigrating juveniles in each ESU, the capture and release associated with research in Permit 133 is not expected to adversely effect UWR chinook salmon, LCR chinook salmon, UWR steelhead or LCR steelhead ESUs.

Permit 1334

Permit 1334 would authorize OREMET to use backpack electrofishing to capture 30 juvenile UWR chinook salmon and 30 juvenile UWR steelhead in the Calapooia River and Oak Creek tributaries to the Willamette River. Indirect mortality of up to one juvenile UWR chinook salmon and one UWR steelhead is estimated as a result of the research activities.

Permit #	ESU	capture/handle/release		indirect mortality		Sacrifice	
		Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
1334	UWR chinook		30		1		
	UWR steelhead		30		1		

NMFS electrofishing guidelines will be observed. The researchers will use a great deal of care to ensure that the captured fish are returned to the river safely. All captured fish will be anesthetized before handling and allowed to recover before being released. There will be no attempt to capture adult listed fish. Based on the NWFSC outmigration estimates NMFS believes that the indirect mortality associated with this research will have no effect UWR chinook salmon or UWR steelhead trout ESUs as a whole.

Permit 1335

Permit 1335 would authorize the USFS to use backpack electrofishing to capture up to 300 juvenile LCR steelhead and five juvenile CR chum salmon at ten randomly selected sites in two tributaries to the Columbia River. Up to six LCR steelhead may be indirectly killed as a result of research activities.

Permit #	ESU	capture/handle/release		indirect mortality		Sacrifice	
		Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
1335	LCR steelhead		300		6		
	CR chum		5				

Effects of the take will be mitigated by adhering to the mitigation measures described earlier. The researchers will use great care to ensure that the captured fish are returned to the river safely.
The loss of six juvenile LCR steelhead out of an estimated total of more than 230,000 outmigrants (NMFS 2001a) would be of negligible effect to the ESU as a whole.

Permit 1336

Permit 1336 would authorize the PBF to use backpack electrofishing and dip–netting to capture up to 25 juvenile UWR chinook salmon, 25 juvenile LCR chinook salmon, 50 juvenile UWR steelhead, and 50 juvenile LCR steelhead in tributaries to the Clackamas, Molalla, Willamette, and Cowlitz Rivers. Up to one juvenile UWR chinook salmon, one juvenile LCR chinook salmon, one juvenile UWR steelhead, and one juvenile LCR steelhead may be indirectly killed as a result of the research activities.

Permit #	ESU	capture/handle/release		indirect mortality		Sacrifice	
		Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
1336	UWR chinook		25		1		
	LCR chinook		25		1		
	UWR steelhead		50		1		
	LCR steelhead		50		1		

While it is not known exactly how many listed fish outmigrate from the sample areas, NMFS estimates (NMFS 2001a) that a total of 230,168 LCR steelhead, 186,655 UWR steelhead, 15,551,406 LCR chinook salmon, and 564,219 UWR chinook salmon will out migrated this year. The one juvenile salmonid to be indirectly killed from each of these ESUs will be a negligible portion of their entire outmigration populations.

Permit 1337

Permit 1337 would authorize OSU to use backpack electrofishing, dip–netting, beach seining, fyke and hoop netting, angling, and trammel netting to capture up to five adult and 50 juvenile UWR chinook salmon and 15 adult and 150 juvenile UWR steelhead in Rickreall Creek. Up to one juvenile UWR chinook salmon and three juvenile UWR steelhead may be indirectly killed as a result of research activities.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1337	UWR chinook	5	50		1		
	UWR steelhead	15	150		3		

Sampling will take place at nine sites in Rickreall Creek. NMFS electrofishing guidelines will be observed. All protected species will be immediately released if captured, carcases of listed fish will be archived at OSU for research purposes.

Though there are no estimates available for how many juvenile UWR chinook salmon and UWR steelhead will be produced in Rickreall Creek. NMFS, however, estimates (NMFS 2001a) that 564,219 juvenile UWR chinook salmon and 186,655 juvenile UWR steelhead will enter the Columbia River below Bonneville Dam. Given the large number of outmigrating fish, the indirect lethal take will have no effect on the ESUs as a whole.

Permit 1338

Permit 1338 would authorize the USFWS to use seines, weirs, and tangle nets to capture adult fish. Fyke nets, weirs, and screw traps may be used to capture juvenile fish. Up to 30 adult and 375 juvenile LCR chinook salmon, 15 adult and 85 juvenile LCR steelhead, and 415 adult and 256,122 juvenile CR chum salmon would be captured in the mainstem Columbia River and tributaries (Hardy Creek and Hamilton Springs). Adult and juvenile chum salmon would be marked and/or tagged, and released. Up to one percent indirect lethal take (one adult and four juvenile LCR chinook salmon, one juvenile LCR steelhead, and four adult and 2,561 juvenile CR chum salmon) may be indirectly killed as a result of handling.

Permit #	ESU	capture/handle/release Adult	Juvenile	indirect mortality Adult	Juvenile	Sacrifice Adult	Juvenile
1338	LCR chinook	30	375	1	4		
	LCR steelhead	15	85		1		
	CR chum	415	120,528	4	1,205		

Hamilton springs is an artificial spring channel designed to enhance and restore CR chum salmon production. To that end, adult CR chum salmon will be trapped anesthetized, counted, radio tagged , bio-sampled (scale removal), jaw tagged, opercle punched, and released into the spawning habitat where they will be monitored. The transmitters will be implanted as quickly and safely as possible. NMFS believes all these measures, with the standard mitigation measures mentioned earlier , will adequately minimize any adverse impacts arising from the capturing, handling, and tagging processes.

In an effort to monitor fish production in the experimental spring channel and calculate adult to smolt indices, juveniles will be captured using floating fyke nets and screw traps. The captured fish would be anesthetized, marked using either small injections of Bizmark brown dye in to their caudal fin (which disappears within three to four weeks), or using a photonic dye injector (a device that uses high pressure to inject dyes into the external tissues), and released.

NMFS estimates (NMFS 2001a) that 301,230 juvenile wild chum salmon will outmigrate to the Columbia Estuary in 2001. The adult CR chum escapement is estimated at 851 fish. The indirect lethal take allowed for adult chum would represent less than 1 % of the predicted escapement. Given the number of outmigrating juvenile LCR chinook and steelhead the amount of indirect lethal take associated with Permit 1338 is not likely to effect the ESU as a whole. Furthermore, chinook and steelhead are not the focus of Permit 1338 and will be released unharmed if captured. It is NMFS' position that any deleterious effects on listed CR chum salmon caused by the authorized take will be offset by the knowledge gained from the research and its application toward the recovery of the species.

Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions not involving Federal activities that are reasonably certain to occur within the action area subject to this consultation. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

State, Tribal and local government actions will likely to be in the form of legislation, administrative rules or policy initiatives. Government and private actions may include changes in land and water uses, including ownership and intensity, any of which could impact listed species or their habitat. Government actions are subject to political, legislative and fiscal uncertainties. These realities, added to the geographic scope of the action area which encompasses numerous government entities exercising various authorities and the many private landholdings, make any analysis of cumulative effects difficult and speculative. This sections identifies representative actions that, based on currently available information, are reasonably certain to occur. It also identifies some goals, objectives and proposed plans by government entities, however, NMFS is unable to determine at this time whether any proposals will result in specific actions.

Representative State Actions

Each state in the Columbia River basin administers the allocation of water resources within its borders. Most streams in the basin are over–appropriated even though water resource development has slowed in recent years. Washington closed the mainstem Columbia River to new water withdrawals, and is funding a program to lease or buy water rights. If carried out over the long term this might improve water quantity. State and local governments are cooperating with each other and Federal agencies to increase environmental protections, including better habitat restoration , hatchery and harvest reforms. NMFS also cooperates with the state water resource management agencies in assessing water resource needs in the Columbia River basin, and in developing flow requirements that will benefit listed fish. During years of low water, however, there could be insufficient flow to meet the needs of the fish. These government efforts could be discontinued or even reduced, so their cumulative effects on listed fish is unpredictable.

Most future actions in Oregon are described in the Oregon Plan for Salmon and Watershed (OPSW). Along with significant harvest and hatchery measures, the OPSW includes the following habitat-related programs designed to benefit salmon and watershed health:

- Oregon Department of Agriculture Water Quality Management plans
- Oregon Department of Environmental Quality Total Maximum Daily (pollutant) Loads (TMDLs) in targeted basins.
- Oregon Watershed Enhancement Board funding programs for watershed enhancement programs, land and water acquisitions.
- ODFW and Oregon Water Resources Department programs to enhance flow restoration.

If these programs are actually implemented, there may be some improvement in various habitat features considered important for the listed species. The Oregon Plan also identifies several private and public cooperative programs for improving the environment for listed species. The success of such programs will depend on continued interest and cooperation among the parties involved.

The state of Washington has various strategies and programs designed to improve the habitat for listed species and assist in recovery planning. One such is the Salmon Recovery Planning Act—a framework for developing watershed restoration projects. The state is also developing a water quality improvement scheme through the development of TMDLs. As with the Oregon initiatives, these programs could benefit the listed species if implemented and sustained.
The Washington state government is cooperating with other governments to increase environmental protection for listed ESUs, including better habitat restoration, hatchery and harvest reforms, and water resource management. The following is a list of many of Washington’s major efforts to protect and restore salmonids and their habitat.

- Washington Wildlife and Recreation Program
- Wild Stock Restoration Initiative
- Joint Wild Salmonid Policy
- Governor’s Salmon Recovery Office

- Conservation Commission
- Salmon Recovery Lead Entities
- Salmon Recovery Funding Board

In the past, each state's economy was heavily dependent on natural resources, with intense resource extraction activity. Changes in the states' economies have occurred in the last decade and are likely to continue with less large scale resource extraction, more targeted extraction methods, and significant growth in other economic sectors. Growth in new businesses is creating urbanization pressures with increased demands for buildable land, electricity, water supplies, waste disposal sites and other infrastructure.

Economic diversification has contributed to population growth and movement in the states, a trend likely to continue for the next few decades. Such population trends will place greater demands in the action area for electricity, water and buildable land; affect water quality directly and indirectly; and increase the need for transportation, communication and other infrastructure development. The impacts associated with economic and population demands will affect habitat features, such as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect is likely to be negative, unless carefully planned for and mitigated.

Some of the state programs described above are designed to address these impacts. Oregon has a statewide land use planning program with growth management and natural resource protection goals. Washington enacted a Growth Management Act to help communities plan for growth and address growth impacts on the natural environment. If the programs continue they may help lessen some of the potential adverse effects identified above.

<u>Local Actions</u>

Local governments will be faced with similar but more direct pressures from population growth and movement. There will be demands for intensified development in rural areas as well as increased demands for water, municipal infrastructure and other resources. The reaction of local governments to such pressures is difficult to assess at this time without certainty in policy and funding. In the past local governments in the action area generally accommodated additional growth in ways that adversely affected listed fish habitat. Also, there is little consistency among local governments in dealing with land use and environmental issues so that any positive effects from local government actions on listed species and their habitat are likely to be scattered throughout the action area.

In both Oregon and Washington local governments are considering ordinances to address aquatic and fish habitat health impacts from different land uses. These programs are part of state planning structures; however, local governments in Oregon are likely to be cautious about implementing new programs because of the passage of a takings constitutional amendment. Some local government programs, if submitted, may qualify for a limit under the NMFS' ESA section 4(d) rule which is designed to conserve listed species. Local governments also may participate in regional watershed health programs, although political will and funding will determine participation and therefore the effect of such actions on listed species. Overall, without comprehensive and cohesive beneficial programs and the sustained application of such programs, it is likely that local actions will not have measurable positive effects on listed species and their habitat, but may even contribute to further degradation.

Tribal Actions

Tribal governments will continue to participate in cooperative efforts involving watershed and basin planning designed to improve fish habitat. The results from changes in Tribal forest and agriculture practices, in water resource allocations, and in changes to land uses are difficult to assess for the same reasons discussed under State and Local Actions. The earlier discussions related to growth impacts apply also to Tribal government actions. Tribal governments will need to apply comprehensive and beneficial natural resource programs to areas under their jurisdiction to produce measurable positive effects for listed species and their habitat.

Private Actions

The effects of private actions are the most uncertain. Private landowners may convert current use of their lands, or they may intensify or diminish current uses. Individual landowners may voluntarily initiate actions to improve environmental conditions, or they may abandon or resist any improvement efforts. Their actions may be compelled by new laws, or may result from population growth and economic pressures. Changes in ownership patterns will have unknown impacts. Whether any of these private actions will occur is highly unpredictable, and the effects even more so.

Summary

Non-federal actions are likely to continue affecting the listed species. The cumulative effects in the action area are difficult to analyze considering the large geographic scope of this opinion, the political variation in the action area, the uncertainties associated with government and private actions, and the changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to increase. Although state, Tribal and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NMFS can consider them “reasonably foreseeable” in its analysis of cumulative effects.

Integration and Synthesis of Effect

UWR chinook salmon

The vast majority of the UWR chinook that will be captured, handled, observed, etc., during the course of the proposed research (a total of 1,426 fish) are expected to survive with no long-term effects. All capture, handling, and holding methods will be minimally intrusive and of short duration. For those fish that do survive (greater than 95%) it is difficult to show that the research has any adverse long–term effects at the individual level, let alone at the population or ESU level. Therefore, any adverse effects of the proposed research activities on the UWR chinook are likely to be limited to lethal take alone.

Maximum Annual Takes of Threatened Upper Willamette River Chinook Salmon

	Adult					Juvenile				
Permit	HANDLE			MORTALITY		HANDLE			MORTALITY	
Action	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT
1140							2			
1156		42					100			2
1256		150			3		450			9
1290							72		20	1
1322							2		7	1
1318							339			7
1326		1					13			
1327							17			
1328		3					84			2
1333		5					9			
1334							30			1
1336							25			1
1337		5					50			1
TOTAL	0	206	0	0	3	0	1,193	0	27	25

KEY: CFT = Collect for Transport; C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

If the total amount of estimated juvenile lethal take for all research activities on UWR chinook (52 juvenile) is expressed as a percentage of the 564,219 fish expected to reach Tongue Point , it represents a loss of .009%. However, and for a number of reasons, that number is in actuality probably much smaller. It is important to remember the fact that every estimate of lethal take for the proposed studies (except for the direct take in Permits 1322 and 1290) has purposefully been inflated and it is therefore very likely that fewer than 52 juveniles will be killed by the research—possibly many fewer. Some of the studies will specifically affect UWR chinook in the smolt stage, but others will not. These latter studies are described as affecting “juveniles,” which means they may target chinook yearlings, parr, or even fry: life stages represented by many more individuals than reach the smolt stage—perhaps as much as an order of magnitude more. Therefore the .009% figure was derived by (a) overestimating the number of fish likely to be killed, and (b) treating each dead UWR chinook as a smolt when some of them clearly won’t be. Thus the actual number of UWR chinook the research is likely to kill is undoubtedly smaller than .009%—perhaps as little as half (or less) of that figure. The loss of a smolt is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many smolts die before they can mature into adults. Typically only 1-12% of the outmigrating smolts survived to return as adults. This indicates that (conservatively) something near 90% of the smolts leaving Willamette River do not survive to return as adults. If this number holds even approximately true for the ESU as a whole, it means that some 90% of the .009% figure would likely be killed during the natural course of events.

The total of estimated lethal take of adult UWR chinook salmon (three individuals) represents 0.1% of the 2,523 fish expected to return to the Willamette River to spawn. As with estimates of juvenile take, the numbers of adult UWR chinook lethal take were intentionally over estimated, making it unlikely that even a 0.1% loss would be realized.

Any adverse effect of 0.009 % juvenile and 0.1 % adult UWR chinook salmon will be a negligible loss.

LCR chinook salmon

The vast majority of the LCR chinook that will be captured, handled, observed, etc., during the course of the proposed research (a total of 11,279 fish) are expected to survive with no long-term effects. All capture, handling, and holding methods will be minimally intrusive and of short duration. For those fish that do survive (greater 95 %) it is difficult to show that the research has any long–term adverse effects at the individual level, let alone at the population or ESU level. Therefore, any adverse effects of the proposed research activities on the LCR chinook are likely to be limited to lethal take alone.

Maximum Annual Takes of Threatened Lower Columbia River Chinook Salmon

	Adult					Juvenile				
Permit	HANDLE			MORTALITY		HANDLE			MORTALITY	
Action	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT
1134			10							
1140							45			1
1156		6					20			
1175							250			5
1252							6			
1290							397		69	8
1291							8,098			162
1293							15			
1312							1			
1318							39			1
1322							1,056		266	12
1326		1					23			
1328							534			11
1333		1					12			
1336							25			1
1338		30			1		375			4
TOTAL	0	38	10	0	1	0	10,896	0	335	205

KEY: CFT = Collect for Transport; C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

If the total amount of estimated lethal take for all research activities—540 juvenile LCR chinook—is expressed as a fraction of the 15,551,406 fish expected to reach Tongue Point , it represents a loss of .003% of the run. However, and for a number of reasons, that number is in actuality probably much smaller. It is important to remember the fact that every estimate of lethal take for the proposed studies (except for the direct take in Permits 1322 and 1290) has purposefully been inflated and it is therefore very likely that fewer than 540 juveniles will be killed by the research—possibly many fewer. Some of the studies will specifically affect LCR chinook in the smolt stage, but others will not. These latter studies are described as affecting "juveniles," which means they may target chinook yearlings, parr, or even fry: life stages represented by many more individuals than reach the smolt stage—perhaps as much as an order of magnitude more. Therefore the .003% figure was derived by (a) overestimating the number of fish likely to be killed, and (b) treating each dead LCR chinook as a smolt when some of them clearly won't be. Thus the actual number of LCR chinook the research is likely to kill is undoubtedly smaller than .003%—perhaps as little as half (or less) of that figure. The loss of a smolt is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many smolts die before they can mature into adults. Typically only 1-12% of the outmigrating smolts survived to return as adults. This indicates that (conservatively) something near 90% of the smolts leaving the Lower Columbia River do not survive to return as adults. If this number holds even approximately true for the ESU as a whole, it means that some 90% of the .003% figure would likely be killed during the natural course of events.

Likewise, the total amount of estimated lethal take for all research activities—one adult LCR chinook—is expressed as a fraction of the 10,000 fish expected to return to the Lower Columbia to spawn, it represents a loss of .01% of the run. And the same arguments can be made about over estimating fish killed and under estimating the number of adults returning. One in all the estimated adult escapement is a small and negligible number, but actually there may be no LCR chinook killed during the research.

Even if the entire .003% of the juvenile LCR chinook population and .01% of the adults were killed, it would be very difficult to translate that number into an actual effect on the species. Therefore, the adverse effect such a loss would have on the ESU is negligible at most.

UWR steelhead

The vast majority of the UWR fish that will be captured, handled, observed, etc., during the course of the proposed research (a total of 448 fish) are expected to survive with no long-term effects. All capture, handling, and holding methods will be minimally intrusive and of short duration. For those fish that do survive (more—probably many more—than 95%) it is difficult to show that the research has any adverse effect at the individual level, let alone the population or ESU levels. Therefore, any adverse effects of the proposed research activities on the UWR steelhead are likely to be limited to lethal take alone.

Maximum Annual Takes of Threatened Upper Willamette River Steelhead

	Adult					Juvenile				
Permit	HANDLE			MORTALITY		HANDLE			MORTALITY	
Action	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT
1140							1			
1156		20					50			1
1290							11			
1318							32			1
1322							2			
1326		1					13			
1327		3								
1328		3					60			1
1333		3					4			
1334							30			1
1336							50			1
1337		15					150			3
TOTAL	0	45	0	0	0	0	403	0	0	8

KEY: CFT = Collect for Transport; C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

If the total amount of estimated lethal take for all research activities—eight juvenile UWR steelhead—is expressed as a fraction of the 186,655 fish expected to reach Tongue Point , it represents a loss of .004% of the run. However, and for a number of reasons, that number is in actuality probably much smaller. It is important to remember the fact that every estimate of lethal take for the proposed studies has purposefully been inflated and it is therefore very likely that fewer than eight juveniles will be killed by the research—possibly many fewer. Some of the studies will specifically affect UWR steelhead in the smolt stage, but others will not. These latter studies are described as affecting “juveniles,” which means they may target steelhead yearlings, parr, or even fry: life stages represented by many more individuals than reach the smolt stage—perhaps as much as an order of magnitude more. Therefore the .004% figure was derived by (a) overestimating the number of fish likely to be killed, and (b) treating each dead UWR steelhead as a smolt when some of them clearly won’t be. Thus the actual number of UWR steelhead the research is likely to kill is undoubtedly smaller than .004%—perhaps as little as half (or less) of that figure. The loss of a smolt is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many smolts die before they can mature into adults. Typically only 1-12% of the outmigrating smolts survived to return as adults. This indicates that (conservatively) something near 90% of the smolts leaving the Willamette River do not survive to return as adults. If this number holds even approximately true for the ESU as a whole, it means that some 90% of the .004% figure would likely be killed during the natural course of events.

Even if the entire .004% of the juvenile UWR steelhead population were killed, it would be very difficult to translate that number into an actual effect on the species. Therefore, the adverse effect such a loss would have on the ESU is negligible at most.

LCR steelhead

The vast majority of the LCR fish that will be captured, handled, observed, etc., during the course of the proposed research (a total of 3919 fish) are expected to survive with no long-term effects. All capture, handling, and holding methods will be minimally intrusive and of short duration. For those fish that do survive (more—probably many more—than 95%) it is difficult to show that the research has any adverse effect at the individual level, let alone the population or ESU levels. Therefore, any adverse effects of the proposed research activities on the LCR steelhead are likely to be limited to lethal take alone.

Maximum Annual Takes of Threatened Lower Columbia River Steelhead

	Adult					Juvenile				
Permit	HANDLE			MORTALITY		HANDLE			MORTALITY	
Action	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT
1102			38							
1135								1,500	48	27
1140							2			
1156		10					25			1
1175							250			5
1252							5			
1290							14			
1291							483	48		11
1293							10			
1312							1			
1318							22			
1322							2			
1326		1					13			
1328		3					12			
1330							260			2
1333		1					1			
1335							300			6
1336							50			1
1338		15					85			1
TOTAL	0	30	38	0	0	0	1,535	1,548	48	54

KEY: CFT = Collect for Transport; C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

If the total amount of estimated lethal take for all research activities—102 juvenile LCR steelhead—is expressed as a fraction of the 230,168 fish expected to reach Tongue Point , it represents a loss of .04% of the run. However, and for a number of reasons, that number is in actuality probably much smaller. It is important to remember the fact that every estimate of lethal take for the proposed studies has purposefully been inflated and it is therefore very likely that fewer than 102 juveniles will be killed by the research—possibly many fewer. Some of the studies will specifically affect LCR steelhead in the smolt stage, but others will not. These latter studies are described as affecting "juveniles," which means they may target steelhead yearlings, parr, or even fry: life stages represented by many more individuals than reach the smolt stage—perhaps as much as an order of magnitude more. Therefore the .04% figure was derived by (a) overestimating the number of fish likely to be killed, and (b) treating each dead LCR steelhead as a smolt when some of them clearly won't be. Thus the actual number of LCR steelhead the research is likely to kill is undoubtedly smaller than .04%—perhaps as little as half (or less) of that figure. The loss of a smolt is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many smolts die before they can mature into adults. Typically only 1-12% of the outmigrating smolts survived to return as adults. This indicates that (conservatively) something near 90% of the smolts leaving the Willamette River do not survive to return as adults. If this number holds even approximately true for the ESU as a whole, it means that some 90% of the .04% figure would likely be killed during the natural course of events.

Even if the entire .04% of the juvenile LCR steelhead population were killed, it would be very difficult to translate that number into an actual effect on the species. Therefore, the adverse effect such a loss would have on the ESU is negligible at most.

<u>CR chum salmon</u>

The vast majority of the CR fish that will be captured, handled, observed, etc., during the course of the proposed research (a total of 121,001 fish) are expected to survive with no long-term effects. All capture, handling, and holding methods will be minimally intrusive and of short duration. For those fish that do survive (more—probably many more—than 95%) it is difficult to show that the research has any adverse effect at the individual level, let alone the population or ESU levels. Therefore, any adverse effects of the proposed research activities on the CR chum are likely to be limited to lethal take alone.

Maximum Annual Takes of Threatened Columbia River Chum Salmon

	Adult					Juvenile				
Permit	HANDLE			MORTALITY		HANDLE			MORTALITY	
Action	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT
1140							2			
1252							30			1
1290							5			
1293							13			
1312							1			
1322							2			
1335							5			
1338			415		4			120,528		1,205
TOTAL	0	0	415	0	4	0	58	120,528	0	1,206

KEY: CFT = Collect for Transport; C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

If the total amount of estimated lethal take for all research activities—1,206 juvenile CR chum—is expressed as a fraction of the 301,320 fish expected to reach Tongue Point , it represents a loss of 0.4% of the run. However, and for a number of reasons, that number is in actuality probably much smaller. It is important to remember the fact that every estimate of lethal take for the proposed studies has purposefully been inflated and it is therefore very likely that fewer than 1,206 juveniles will be killed by the research—possibly many fewer. Some of the studies will specifically affect CR chum in the smolt stage, but others will not. These latter studies are described as affecting “juveniles,” which means they may target chum yearlings, parr, or even fry: life stages represented by many more individuals than reach the smolt stage—perhaps as much as an order of magnitude more. Therefore the 0.4% figure was derived by (a) overestimating the number of fish likely to be killed, and (b) treating each dead CR chum as a smolt when some of them clearly won’t be. Thus the actual number of CR chum the research is likely to kill is undoubtedly smaller than 0.4%—perhaps as little as half (or less) of that figure. The loss of a smolt is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many smolts die before they can mature into adults. Typically only 1-12% of the outmigrating smolts survived to return as adults. This indicates that (conservatively) something near 90% of the smolts leaving the Willamette River do not survive to return as adults. If this number holds even approximately true for the ESU as a whole, it means that some 90% of the 0.4% figure would likely be killed during the natural course of events.

Likewise, the total amount of estimated lethal take for all research activities—four adult CR chum—is expressed as a fraction of the 851 fish expected to return to the Lower Columbia to spawn, it represents a loss of less than 0.5% of the run. And the same arguments can be made about over estimating fish killed and under estimating the number of adults returning. Less than half a percent of all the estimated adult escapement is a small and negligible number, but the actual number of CR chum the research is likely to kill is undoubtedly smaller.

Even if the entire 0.4% of the juvenile CR chum population and 0.5% of the adults were killed, it would be very difficult to translate that number into an actual effect on the species. Therefore, the adverse effect such a loss would have on the ESU is negligible at most.

Nonetheless, regardless of its magnitude, that negative effect must be juxtaposed with the benefits to be derived from the research (see descriptions of the individual permits). Those benefits range from finding ways to improve salmonid survival through the Columbia River Hydropower System (Permit 1134) to determining the degree to which they are being harmed during their freshwater residence (permit 1328) to providing basic information on the means to restore their habitat (Permit 1338). In all, the fish will derive some benefit from every permit considered in this Opinion. The amount of benefit will vary, but in some cases it may be significant. Therefore, in deciding whether to issue the permits considered here, NMFS must compare the tangible benefits they will produce (some of which are potentially significant) with the certainly negligible adverse effects they will cause. Moreover, NMFS must weigh similar factors (benefit versus adverse effect) when deciding whether the contemplated actions will appreciably reduce the likelihood of survival and recovery for each of the ESUs covered under this document—the critical determination in issuing any biological opinion.

Conclusions

After reviewing the current status of the threatened ESU's under consultation, the environmental baseline for the action area, the effects of the proposed section 10(a)(1)(A) permit actions, and cumulative effects, it is NMFS' biological opinion that issuance of the proposed permits is not likely to jeopardize the continued existence of threatened ESU's under consultation nor destroy nor adversely modify their critical habitat.

Reinitiation of Consultation

Consultation must be reinitiated if: The amount or extent of annual takes specified in the permits and the Incidental Take Statement of this consultation is exceeded or is expected to be exceeded; new information reveals effects of the actions that may affect the ESA-listed species in a way not previously considered; a specific action is modified in a way that causes an effect on the ESA-listed species that was not previously considered; or a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

"Essential fish habitat" (EFH) is defined in section 3 of the Magnuson-Stevens Act (MSA) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The MSA and its implementing regulations at 50 CFR 600.920 require a Federal agency to consult with NMFS before it authorizes, funds or carries out any action that may adversely effect EFH. The purpose of consultation is to develop a conservation recommendation(s) that addresses all reasonably foreseeable adverse effects to EFH. Further, the action agency must provide a detailed, written response NMFS within 30 days after receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with NMFS' conservation recommendation the agency must explain its reasons for not following the recommendations.

The objective of this consultation is to determine whether the proposed actions, the funding and issuance of scientific research permits under section 10(a)(1)(A) of the ESA for activities within the states of Oregon and Washington, is likely to adversely affect EFH. If the proposed actions are likely to adversely affect EFH, a conservation recommendation(s) will be provided.

Identification of Essential Fish Habitat

The Pacific Fishery Management Council (PFMC) is one of eight Regional Fishery Management Councils established under the Magnuson-Stevens Act. The PFMC develops and carries out fisheries management plans for Pacific coast groundfish, coastal pelagic species and salmon off the coasts of Washington, Oregon and California. Pursuant to the MSA, the PFMC has designated freshwater and marine EFH for chinook and coho salmon (PFMC 1999). For purposes of this consultation, freshwater EFH for salmon in Oregon and Washington includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to Pacific salmon, except upstream of the following impassable dams: Opal Springs, Big Cliff, Cougar, Dexter, Dorena, Soda Springs, Lost Creek, Applegate, Bull Run, and Oak Grove. In the future, should subsequent analyses determine the habitat above any of these dams is necessary for salmon conservation, the PFMC will modify the identification of Pacific salmon EFH (PFMC 1999). Marine EFH for Pacific salmon in Oregon and Washington includes all estuarine, nearshore and marine waters within the western boundary of the U.S. Exclusive Economic Zone (EEZ), 200 miles offshore.

Proposed Action and Action Area

For this EFH consultation the proposed actions and action area are as described in detail in Part II of the ESA consultation above. The actions are the funding and issuance of a number of scientific research permits pursuant to section 10(a)(1)(A) of the ESA. The proposed action area is the Upper Columbia River basin, including all river reaches accessible to salmon in Columbia River tributaries upstream to Chief Joseph dam in Washington. A more detailed description and identification of EFH for salmon is found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the impacts to these species' EFH from the above proposed action is based on this information.

Effects of the Proposed Action

Based on information submitted by the action agencies and permit applicants, as well as NMFS' analysis in the ESA consultation above, NMFS believes that the effects of this action on EFH are likely to be within the range of effects considered in the ESA portion of this consultation.

Conclusion

Using the best scientific information available and based on its ESA consultation above, as well as the foregoing EFH sections, NMFS has determined that the proposed actions are not likely to adversely affect EFH Pacific salmon.

EFH Conservation Recommendation

The Reasonable and Prudent Measures and the Terms and Conditions outlined above in Part VIII of the ESA consultation are applicable to designated salmon EFH. Therefore, NMFS recommends that those same Reasonable and Prudent Measures, and the Terms and Conditions be adopted as the EFH Conservation Recommendation for this consultation. If these EFH conservation recommendations are adopted, potential adverse impacts to EFH will be minimized.

Statutory Response Requirement

Section 305(b)(4)(B) of the MSA and implementing regulations at 50 CFR section 600.920 require a Federal action agency to provide a detailed, written response to NMFS within 30 days after receiving an EFH conservation recommendation. The response must include a description of measures proposed by the agency to avoid, minimize, mitigate or offset the impact of the activity on EFH. If the response is inconsistent with a conservation recommendation from NMFS, the agency must explain its reasons for not following the recommendation.

Consultation Renewal

The action agencies must reinitiate EFH consultation if plans for these actions are substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for the EFH conservation recommendations (50 CFR Section 600.920(k)).

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